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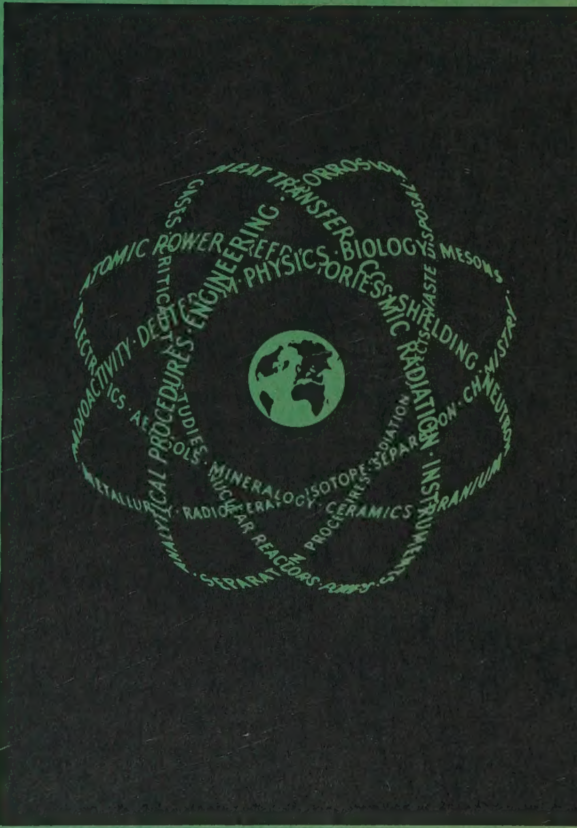

September 30, 1959

Volume 13 Number 18A
Abstracts 15821–16663

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The category "Patents" has been discontinued, and abstracts of patents are now being categorized according to the subject content. References in the Subject Index to abstracts of patents will continue to be identified by the letter "P".

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NUCLEAR SCIENCE ABSTRACTS

Volume 13 Number 18A September 30, 1959

GENERAL

15821 SCTM-246-56(51)
Sandia Corp., Albuquerque, N. Mex.
A NUCLEAR EXPLOSION TO DETERMINE THE EFFECTS ON HURRICANES DURING THE INTERNATIONAL GEOPHYSICAL YEAR. Jack W. Reed. Aug. 8, 1956. 11p. Contract [AT(29-1)-789]. $0.50 (OTS).

It is proposed that a nuclear device, of megaton class, be burst in the strong wind zone of a mature hurricane over the open ocean. It is postulated that it would cause circulation asymmetries which might affect storm motion and intensity to a degree which would protect coastal areas. Measurement and verification of test results could best be made during the International Geophysical Year, when great numbers of extra weather observations are planned, particularly over oceanic areas. (auth)

15822
WORLD SURVEY OF FILMS ON NUCLEAR ENERGY. *Nuclear Energy Engr., Suppl., 1-24(1959) June.*

A list of the titles of over 200 films are presented. Full details of these films including the names of the producers and distributors for non-commercial screening are reported. Addresses of distributors in UK and overseas are given. (W.L.H.)

15823
REMOVAL OF FUMES FROM GASES. Jozef Kazimierz Tylko (to British Oxygen Co., Ltd.). British Patent 816,001. July 8, 1959.

Solid particle removal from gases by agglomeration followed by separation in cyclones or scrubbers is described. The particles are given a charge by a radiation source such as radioisotopes and agglomerate and are separated. The radioisotope source can be positioned in a conduit in several ways. (T.R.H.)

BIOLOGY AND MEDICINE

15824 AD-161586
Virginia. Agricultural Experiment Station, Blacksburg.
LONG-TERM DOG-FEEDING OF IRRADIATED AND CONTROL SHRIMP AND CARROTS (PHASE 1) AND NUTRITIVE VALUE OF IRRADIATED AND CONTROL PROTEINS (PHASE 2). Progress Report No. 2 [for] Six Month Period Ending March 15, 1958. R. W. Engel, D. F. Watson, and H. G. Windmueller. 13p. Contract DA-49-007-MD-784.

A diet containing 35% of solids of either irradiated carrots or shrimp produced no deleterious effects in beagle puppies maintained on the diet for a 6-month period. Data are included on growth rate, hemoglobin and blood cell levels, and food efficiency. (C.H.)

15825 AD-202424
Basic Vegetable Products, Inc., Vacaville, Calif.
EFFECTS OF IRRADIATING ONIONS. Report No. 7. (Progress) [for] June 19, 1956—March 27, 1958. Albert S. Porter. 4p. Contract QMR&D (NATICK) No. 47.

Exposure to 100,000 rad x radiation inhibited sprouting in onions exposed in sealed polyethylene-myar gas-impermeable bags. A beneficial effect was also noted in onions innoculated with *Botrytis alii* mycelium and exposed in sealed bags. Onions exposed in open bags soon spoiled. High radiation doses rendered the onions worthless. (C.H.)

15826 AD-203174
Michigan State Univ., East Lansing.
CONTROL OF STORAGE ROT OF POTATOES BY GAMMA IRRADIATION. Progress Report No. 8 [for] January 1, 1958—February 28, 1958. W. J. Hooker, D. R. Isleib, and D. T. Duncan. 27p. Project No. 7-84-01-002. Contract DA19-129-QM-791.

The response of four varieties of potatoes to a range of cobalt-60 gamma irradiation levels from zero to 15 kilo-rep was measured. The formation of periderm and suberin, the incidence of tuber rot, the influence of storage temperature, the identity of rot producing organisms, and the nature of wound healing were studied. (C.H.)

15827 AECU-4119
Department of Agriculture. Agricultural Research Service, Beltsville, Md.
POLONIUM UPTAKE BY PLANTS. R. G. Menzel. [1953?] 4p. $1.80(ph), $1.80(mf) OTS.

Data are tabulated on the uptake of polonium by plants. The distribution of polonium was measured in red clover, Sudan grass, and astragalus following uptake of polonium-210 from solutions. (C.H.)

15828 AECU-4143 and Suppl.
Los Alamos Scientific Lab., N. Mex.
BIBLIOGRAPHY ON THE TOXICOLOGY OF BERYLLIUM. Gretchen R. Riese, comp. Jan. 2, 1957. 40p. Includes Supplement. 14p. Contract [W-7405-eng-36]. (D-BIB-1 and Suppl.). $9.30(ph), $3.60(mf) OTS.

This bibliography on the toxicology of beryllium includes references from the medical literature between 1942 and 1956. (C.H.)

15829 AF-SAM-58-156
Washington. Univ., Seattle.
THE COMBINED EFFECTS OF IONIZING RADIATION AND HIGH TEMPERATURE ON THE LONGEVITY OF THE WHITE RAT. L. D. Carlson and B. H. Jackson. Mar. 1959. 12p.

Male Sprague-Dawley rats, individually caged, were exposed to low level irradiation from a Co^{60} source for 16 hours a day. The animals were selected by weight and growth rate, and divided into eight groups of 22 rats. Four groups were kept at 28° ± 1°C and were exposed to 0.29, 0.64, 2.60, and 4.18 r/day during the irradiation period, which lasted from 4 to 16 months of age. The other groups were kept at 35° ± 1°C during the period of irradiation which lasted from 4 to 16 months of age, and were exposed to 0.28, 0.60, 2.57, and 3.96 r/day. At 35°C the ET_{50} for 0.29 r/day was 310; 0.64 r/day was 490; 2.60 r/day was 540; and 4.18 r/day was 510. At 28°C the ET_{50} for 0.28 r/day was 493; 0.60 r/day was 510; 2.57 r/day was 810; and 3.96 r/day was 590. With the exception of the relation between 0.60 and 0.28 r/day, the data are statistically significant at the 5 percent level. From a previous experiment at 26°C the ET_{50} for 0 r/day was 445 and 0.8 r/day was 585. It is suggested that the effects of ionizing irradiation interact with the effects of environment in influencing longevity. (auth)

15830 AF-SAM-59-18
Texas. Univ., Austin. Radiobiological Lab.
TRANSFER BY NORMAL AND CHRONIC FOCAL-HEAD IRRADIATED MONKEYS OF A SINGLE LEARNED DISCRIMINATION ALONG A PERIPHERAL CUE GRADIENT. A. A. McDowell and W. Lynn Brown. Aug. 15, 1958. 4p.

Nine normal monkeys, three monkeys with previous focal-head irradiation of the posterior association areas, and two monkeys with previous focal-head irradiation of the frontal association areas were tested for transfer of a simple learned discrimination along a peripheral cue gradient. The results of the study demonstrated that there was no significant difference in performance between normal and chronic focal-head irradiated monkeys, and there was a significant change in performance as a function of degree of spatial separation between the relevant discriminanda and site of food reward. (auth)

15831 AF-SAM-59-41
School of Aviation Medicine, Randolph AFB, Tex.; Texas. Univ., Austin. Radiobiological Lab.; and Southwest Research Inst., San Antonio.
ACUTE EFFECTS OF GAMMA RADIATION IN PRIMATES. Ralph G. Allen, Jr., Frank A. Brown, Loren C. Logie, David R. Rovner, Stephen G. Wilson, Jr., and Robert W. Zellmer. Jan. 13, 1959. 24p.

One hundred seven Macaca mulatta monkeys were exposed in 16 groups to rapid delivery of Co^{60} gamma rays at doses of 400 to 40,000 r. Statistical evaluation of the survival time determination of the $LD_{50/30}$ dose, clinical observations for a 30-day postirradiation period, and immediate postmortem examinations were performed. These three approaches to the investigation of the mechanism of radiation injury and death in the monkey were evaluated. Each method separated the groups of animals into three distinct and corresponding categories. The clinical and pathologic studies undertaken in this experiment provide further elucidation of the central nervous system, gastrointestinal, and hematopoietic types of radiation death. (auth)

15832 BNL-512
Brookhaven National Lab., Upton, N. Y.
THE PHOTOCHEMICAL APPARATUS—ITS STRUCTURE AND FUNCTION. REPORT OF SYMPOSIUM HELD JUNE 16-18, 1958. Brookhaven Symposia in Biology No. 11. 374p. $3.50(OTS).

The subjects covered by the papers presented at this conference are: physical chemical aspects, biochemical aspects, morphological aspects, enzymatic activities of chloroplasts, and enzymatic properties of primitive photochemical structures. (W.L.H.)

15833 COO-218
Utah. Univ., Salt Lake City. Radiobiology Lab.
ANNUAL PROGRESS REPORT. C. N. Stover, Jr., ed. Mar. 31, 1959. 229p. Contract AT(11-1)-119. $34.80(ph), $9.90(mf) OTS.

Progress is reported in studies on the long-term toxic effects of radioactive heavy metals in dogs. Data are included on the pathological effects of plutonium, radium, thorium, and strontium-90, the measurement of lead-210 in bone of dogs injected with radium-226, the skeletal retention of injected thorium-228, whole-body retention of thoron daughters, the escape of beta-energy from the skeleton, and the histopathologic changes in bones containing plutonium. Photographs of contact autoradiograms of bones and injection techniques are presented. Abstracts of papers presented and a list of publications during the period are included. (For preceding period see COO-215.) (C.H.)

15834 HW-60062
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
METABOLISM OF Zn^{65} IN THE RAT. J. E. Ballou. Apr. 17, 1959. 12p. Contract W-31-109-eng-52. $3.30(ph), $2.40(mf) OTS.

The gastrointestinal absorption of Zn^{65} was determined after feeding solutions of different specific activities and following administration of suspensions of plant and animal tissues containing the isotope. Following intravenous administration, Zn^{65} was excreted largely via the feces. Early deposition was highest in the visceral organs which lost the isotope rapidly. Smaller amounts of Zn^{65} deposited in bone were retained with a biological half life of 250 days. Based on bone as the critical organ with an effective half life of 125 days, the MPC for Zn^{65} in water was calculated to be 1×10^{-2} μc/ml. (auth)

15835 NADC-MA-5813
Franklin Inst. Labs. for Research and Development, Philadelphia.
SURVEY OF REACTOR FACILITIES FOR RADIATION BIOLOGY RESEARCH. Report No. 1. Musa Halev. Oct. 22, 1958. 185p. Project NM 19-03-12.2. (AD-209586).

A comprehensive survey of unclassified literature was made regarding the application of nuclear reactors to biological research. The properties of reactor radiation are summarized. Principal attention is directed to techniques for modifying this radiation for biological experiments. The relative advantages of reactors as compared with other radiation sources are recapitulated. Safety, the effects of experiments on reactivity, and other reactor operating problems are discussed, as also are the costs and operating expenses of various types of installations. Reactor experimental facilities are described, with particular emphasis on biological experimental irradiation facilities. All known reactors being constructed or planned primarily for medical purposes are described. Appendices include a very extensive bibliography and a survey questionnaire, previously issued as a separate document. In the survey, nearly all laboratories having experience in the field of radiation biology research replied to questions relating mainly to the application of nuclear radiation in their own researches. 360 references. (auth)

15836 ORINS-19
Oak Ridge Inst. of Nuclear Studies, Inc., Tenn.
THYROID RADIOIODINE UPTAKE MEASUREMENT. A Standard System for Universal Intercalibration. June 1959. 329p. Contract AT-40-1-GEN-33. $3.50 (OTS).

Methods of measurement used in thyroid radioiodine uptake studies are discussed. Results of a thyroid uptake calibration survey are reviewed. A simple standard procedure is described which uses a spectrometrically calibrated phantom and standard counting equipment. (C.H.)

15837 ORO-201
Meharry Medical Coll., Nashville.
THE DISTRIBUTION OF Ag^{111} IN RATS USING HISTOPATHOLOGICAL AND AUTORADIOGRAPHIC TECHNIQUES. Final Report. 1959. 26p. Contract AT(40-1)-2025. $4.80(ph), $2.70(mf) OTS.

The distribution of Ag^{111} was studied in rats following intravenous, intraperitoneal, and intragastric administration. Microscopic autoradiography techniques were used. Five minutes after intravenous administration, silver was found in all organs examined, with heaviest deposition in the reticulo-endothelial system. These tissues retained high levels of radioactivity over a 24 hour period. Intraperitoneal studies revealed that the majority of silver is retained at the site of injection after 24 hours. At the end of six days, considerable amounts of silver were demonstrable in the liver parenchyma, red pulp of the spleen, glomeruli of the kidney, and in the longitudinal muscles of the large intestines. Appreciable amounts of Ag^{111} are not absorbed from the gastrointestinal tract when the isotope was given by intubation. Pathological changes in tissue from the intravenous experiments are described. (auth)

15838 UCLA-383
California. Univ., Los Angeles. Atomic Energy Project.
RADIOIRON STUDY OF ERYTHROPOIESIS AFTER X-IRRADIATION. Thomas G. Hennessy and James P. Okunewick. Dec. 14, 1956. 10p. Contract AT-04-1-GEN-12. $1.80(ph), $1.80(mf) OTS.

A serial study of radioiron uptake in circulating red cells of Wistar rats was done. It was demonstrated that following the initial depression by a dose of 100 r of total body x irradiation there is a rapid rise in marrow activity exceeding normal incorporation of iron by 4 days and returning to normal levels at 8 or 9 days. (auth)

15839 UR-548
Rochester, N. Y. Univ. Atomic Energy Project.
AN EXPERIMENTAL STUDY OF RETINAL BURNS: PART I. THE IRRADIANCE THRESHOLDS FOR CHORIO-RETINAL LESIONS. PART II. ENTOPTIC SCATTER AS A FUNCTION OF WAVE LENGTH. Donald W. Demott and Thomas P. Davis. May 11, 1959. 13p. Contract W-7401-eng-49. $3.30(ph), $2.40(mf) OTS.

Using a high intensity light source to produce chorioretinal lesions in the eyes of rabbits, cats, and guinea pigs, the authors determined, at different levels of retinal irradiance, the exposure time which produced an ophthalmoscopically visible lesion. It was found that, at irradiance levels greater than 2 cal/cm^2/sec, a radiant exposure of 1.0 cal/cm^2 produced a threshold lesion. At irradiance levels less than 0.7 cal/cm^2/sec, lesions could not be produced at any exposure time through ten seconds. Histological data on the nature of the lesions and course of healing are presented and discussed. (auth)

15840 USNRDL-TR-319
Naval Radiological Defense Lab., San Francisco.
INHIBITION OF DNA SYNTHESIS BY SODIUM IONS. E. R. Walwick and R. K. Main. May 12, 1959. 9p.

The basic puzzle of radiobiology is still unsolved, namely that comparatively small doses of radiation produce marked biological changes, although in general, rather large doses are required to produce easily observable *in vitro* chemical changes. In order to shed light on the cause of this anomaly, studies concerning the synthesis of DNA in a readily available and controllable *in vitro* system were initiated. This system is essentially that of Bollum and Potter, a particulate-free enzyme system derived from the cytoplasm of rat thymus cells. For this study a reliable method of measuring tritiated thymidine incorporation into DNA, as detected by a liquid scintillation counting technique, was devised and tested. The magnitude of the limits of variability was within 3% of the mean, and counting efficiency attained by this method was 11.3%. It was found that sodium ions at concentrations within physiological limits and in the presence of optimal amounts of Mg^{2+} ions markedly inhibit DNA synthesis. Data are cited from the literature which indicates that x irradiation causes an immediate increase in intracellular sodium concentrations. A working hypothesis is suggested in which the depression of DNA synthesis, within cells subsequent to x irradiation, is mediated by way of concomitant changes in intracellular cation concentrations. (auth)

15841 AEC-tr-3726
METHOD OF MICRODETERMINATION OF ANTIMONY IN URINE AND BLOOD OF PATIENTS SUFFERING FROM VISCERAL LEISHMANIASIS IN SOLYUSUR'MIN THERAPY. L. N. Lapin. Translated for Los Alamos Scientific Lab. from *Voprosy Med. Khim.* *2*, 309-15 (1956). 9p. $1.80(ph), $1.80(mf) JCL or LC.

The qualitative reaction based on the combining of $SbCl_6^-$ with brilliant green, acting as cation, can be used for microdetermination of antimony in small samples of urine and blood. Toluene extraction of the compound formed makes it unnecessary to conduct preliminary processing of the material to free it from proteins, sugar, urea, uric acid and other biological substances. This considerably simplifies the method and makes it more accurate. The great sensitivity of the action makes it possible to operate with an amount of material that does not exceed 0.1 to 0.2 ml. (auth)

15842 JPRS/DC-441
EXOGENOUS INFECTIONS IN RADIATION SICKNESS. R. V. Petrov. Translated from *Uspekhi Sovremennoĭ Biol.* *46*, 48-61(1958). 23p. $0.50(OTS).

Increased susceptibility of irradiated animals to pathogenic microörganisms causing infectious diseases was accompanied not only by more severe cases of infection and a higher mortality rate, but also by characteristic symptoms. These characteristic symptoms were not just a combined effect of two pathological processes, but the result of their complicated interaction. (C.H.)

15843 JPRS-L-517-N

DATA ON THE TOXICOLOGY OF RADIOACTIVE RUTHENIUM FOLLOWING ADMINISTRATION THROUGH THE GASTROINTESTINAL TRACT. V. N. Strel'tsova. Translated from Med. Radiol. 3, No. 5, 37-49(1958). 24p. $0.50(OTS).

Data on the toxicity of ruthenium-106 are reviewed. Studies were made on the effect of daily doses of ruthenium-106 administered to rats over a 100-day period. Pathological findings are tabulated and discussed. (C.H.)

15844 JPRS-L-518-N

THE EFFECT OF COMPLEX-FORMERS ON THE EXCRETION OF RADIOACTIVE ISOTOPES (STRONTIUM, YTTRIUM, AND CERIUM). Yu. I. Moskalev and L. M. Budko. Translated from Med. Radiol. 3, No. 5, 50-7(1958). 15p. $0.50(OTS).

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 2674.

15845 JPRS-L-519-D

THE COURSE OF WOUNDS IN THE SMALL INTESTINES DURING RADIATION DISEASE. V. I. Filatov. Translated from Voenno-Med. Zhur., No. 6, 37-40 (1957). 8p. $0.50(OTS).

A study was made of the pathology of surgical wounds of the intestine during radiation sickness. Dogs and rabbits were used as test animals. The operations were performed under anesthesia, and antibiotics were instilled in the abdominal cavity of the animals following the operation. Injuries of the small intestine produced during the climax of radiation disease resulted in a high mortality rate and injuries of the intestines produced 2 to 3 months after irradiation were followed by hematological changes and the process of healing of the wounds was accompanied by frequent infections. (C.H.)

15846 JPRS-L-640-N

ELIMINATION OF Sr^{89} FROM THE RAT ORGANISM UNDER NORMAL CONDITIONS AND UNDER THE INFLUENCE OF PARATHYREOCRINE, CAMPOLONE, AND SODIUM CITRATE. O. A. Khomutovs'kii (Khomutovs'kiy). Translated from Fiziol. Zhur., Akad. Nauk Ukr. R.S.R. 4, 249-55(1958). 13p. $0.50(OTS).

The larger part of Sr^{89} administered by injection into the peritoneal cavity of rats is deposited in the bones. Accumulation of strontium per gram of osseous tissue (femur) in rats weighing 140 to 160 g is twice greater than that in rats weighing 190 to 210 g. Accumulations of Sr^{89} in the soft tissues are of insignificant amounts, being of the order of tenths and thousandths of a percent of the injected dose of isotope. Changing the dose of administered Sr^{89} from 0.008 to 0.056 microcuries per gram body weight of the animal had little effect on its accumulation in the soft tissues. The excretion of Sr^{89} in rats, upon injection of the isotope into the peritoneal cavity, takes place primarily during the first two days. The major part of the Sr^{89} is excreted in the urine. During the first five days, rats weighing 140 to 160 g excrete Sr^{89} in the urine and feces in smaller amounts than do rats weighing more than 170 g. Excretion of Sr^{89} on the 35th day after injection is approximately 0.27 percent of the injected dose. With the use of preparations which shift mineral metabolism (parathyreocrine, campolone) in combination with a complex-forming substance (sodium citrate), the excretion of Sr^{89} in rats is increased by 12 to 28 percent. (auth)

15847 JPRS(NY)-L-279

THE PRINCIPLES OF ANTIBIOTIC THERAPY IN ACUTE RADIATION SICKNESS. R. V. Petrov and V. D. Rogozkin. Translated from Patolog. Fiziol. i Eksptl'. Terap. 2, 3-11(1958). 22p. (PB-141142-T). $0.50 (OTS).

The effects of antibiotic therapy on radiation sickness were studied in rats and dogs. Data are tabulated and results are discussed. (C.H.)

15848 JPRS(NY)-L-440

ON THE PROBLEM OF UTILIZING FIBRIN FILMS AFTER IRRADIATION OF THE SKIN SURFACE. S. A. Papoyan, S. N. Alleverdyan, I. G. Demirchoglyan, and I. A. Yerzinkyan. Translated from Med. Radiol. 2, No. 6, 61-4(1957). 6p. (PB-141339-T). $0.50(OTS).

Fibrin films gave good results for the treatment of radiation injuries of the skin. (C.H.)

15849 JPRS(NY)-L-433

SPECIFIC CHANGES IN THE PERIPHERAL BLOOD OF PREGNANT ANIMALS AFTER SINGLE IRRADIATION BY X-RAYS. N. M. Andriyasheva. Translated from Med. Radiol. 2, No. 6, 19-25(1957). 10p. (PB-141332-T). $0.50(OTS).

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 5166.

15850 JPRS-tr-1075-N

THE USE OF COLLOIDAL INFUSION IN THE COMBINED THERAPY OF RADIATION SICKNESS. L. S. Rogacheva. Translated from Patolog. Fiz. i Eksptl'. Terap. 2, No. 4, 38-42(1958). 8p. $0.50(OTS).

A protein colloidal infusion gave good results when used as a blood substitute in the treatment of acute radiation sickness in dogs. The colloidal infusion did not induce anaphylactic reactions and could be used frequently in large amounts. It was found to have a stimulating effect as well as a replacement value. The blood substitute also gave good results in the treatment of patients with hypoproteinemia. In patients with nutritional dystrophy, injections of the colloidal infusion significantly reduced the permeability of capillaries. (C.H.)

15851 JPRS-tr-1076-N

THE CONTENT OF CORTICOSTERONE IN SUPRARENAL BLOOD OF RATS AT VARIOUS PERIODS AFTER IRRADIATION. M. A. Larina and T. S. Sakhatskaya. Translated from Problemy Endokrinol. i Gormonoterap. 4, No. 4, 21-4(1958). 8p. $0.50(OTS).

Immediately after irradiation the content of corticosterone in adrenal blood of rats was reduced to 40% of normal. The reduction gradually declined to zero after three hours, after which it gradually increased until at 24 hours it exceeded the level of controls by 35%. The injection of ACTH into the rats within three hours after irradiation induced secretion of this hormone by the adrenals. The amount of corticosterone in the blood reached control levels. It was concluded that the reduced concentration of corticosterone in the blood from the adrenals was due to disturbance of the pituitary regulatory function and not to injury of the adrenals themselves. (C.H.)

15852 JPRS-tr-1077-N

THE PROPHYLACTIC AND THERAPEUTIC ACTION

OF SOMATOTROPIC HORMONE IN RADIATION AFFECTION. D. E. Grodzenskii (Grodzenskiy), A. Ye. Rabkina, and E. R. Bagramyan. Translated from Problemy Endokrinol. i Gormonoterap. 4, No. 4, 31-7 (1958). 12p. $0.50(OTS).

Injections of the pituitary hormone, somatotropin, had a decided prophylactic effect when administered to rats before radiation exposure. When injected after irradiation, a decrease was noted in loss of weight, but no increase was noted in survival period. The findings are discussed. (C.H.)

15853 JPRS-tr-L-579-N

THE DEVELOPMENT OF THE MOST ACUTE FORM OF RADIATION SICKNESS. L. F. Semenov. Translated from Med. Radiol. 3, No. 3, 70-7(1958). 13p. $0.50(OTS).

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 13676.

15854 JPRS-tr-L-581-N

IMMUNOBIOLOGICAL REACTIVITY OF AN IRRADIATED ORGANISM. N. N. Klemparskaya. Translated from Med. Radiol. 3, No. 3, 85-90(1958). 13p. $0.50 (OTS).

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 13678.

15855 NP-tr-246

UTILIZATION OF ISOTOPES AND IRRADIATION FOR SCIENTIFIC INVESTIGATIONS IN ANIMAL HUSBANDRY. (Nauchnye issledovaniia po zhivotnovodatvu i veterinarii s ispol'zovaniem izotopov i izluchenii.) P. A. Kartashov. Translated from Veterinariya 35, No. 10, 94-5(1958). 6p.

Papers presented at a conference on applications of radioactive and stable isotopes in agricultural studies are summarized briefly. (C.H.)

15856

DEPOSITION AND RETENTION OF FLUORIDE AND RADIOCALCIUM IN THE GROWING RAT. R. C. Likins, R. O. Scow, I. Zipkin, and A. C. Steere (National Institute of Health, Bethesda, Md.). Am. J. Physiol. 197, 75-80(1959) July.

Radiocalcium and fluoride were administered daily for 30 days to young rats. At 30 and 60 days, the tibia, femur, mandible, teeth and remaining skeleton were analyzed for Ca^{45} and F. The tibia was divided into several segments including the proximal epiphysis, the original diaphyseal segment, and those portions of the diaphysis added from 0 to 30 days and 30 to 60 days. Fluoride had no effect on the Ca^{45} or ash of bone but reduced Ca^{45} uptake by molar enamal. Ratios of F to Ca^{45} were dissimilar in the various tibial segments. Between 30 and 60 days essentially no Ca^{45} or F was lost from the skeleton, tibia or tibial segments excepting the 0–30-day proximal diaphyseal increment. Seventy per cent of the Ca^{45} and forty per cent of the F lost from this segment was found in the adjacent segment formed during the second 30-day period. These results suggest that much of the Ca^{45} and F released during remodeling of the ends of the growing bone did not enter the general circulation, but was deposited in the immediate vicinity. (auth)

15857

POLYDIPSIA AND POLYURIA BY THE X-IRRADIATED RAT. Robert E. Kay and Cecil Entenman (Naval Radiological Defense Lab., San Francisco). Am. J. Physiol. 197, 169-72(1959) July.

The results of partial-body x irradiation experiments established the abdomen as the radiosensitive area involved in post-irradiation polydipsia and polyuria. However, the responses do not appear to be due to the action of x rays on any one organ in this region, since x irradiation of individual exteriorized organs was only partially effective. On the other hand, shielding of the exteriorized kidneys or liver was effective in the prevention of postirradiation polyuria and polydipsia. Removal of the adrenal glands or spleen prior to x irradiation did not prevent polydipsia or polyuria, whereas removal of the pancreas greatly diminished the extent of the polydipsia and polyuria and removal of the pituitary gland eliminated the responses. Anoxic anoxia during the time of x irradiation did not prevent polyuria or polydipsia, but when isotonic sugar solutions were given as the drinking fluid polyuria and polydipsia did not occur. (auth)

15858

EXPERIMENTAL RESEARCH ON THE FUNCTIONAL BEHAVIOR OF THE LYMPH NODES SUBMITTED TO IRRADIATION. A. Toti and M. Fabi (Università, Ferrara, Italy and Ospedale S. Anna, Ferrara, Italy). Boll. soc. ital. biol. sper. 35, 568-70(1959) May 31. (In Italian)

The functional behavior of the lymph nodes of rabbits submitted to irradiation was studied. The lymph nodes in the popliteal space were fractionally irradiated on alternate days with 200 r until a total dose of 3000 r was obtained. A progressive reduction in the volume of the lymph nodes was observed until they were reduced to $\frac{1}{3}$ their original size. (J.S.R.)

15859

A SYSTEM IN THE MAMMALIAN SKIN SENSITIVE TO X IRRADIATION AND INSENSITIVE TO THE OXYGEN EFFECT. Z. M. Bacq, P. Ciccarone, and J. Renson (Univ. of Liège). Experientia 15, 175-6(1959).

Saline solution was injected into deep dermal layers of young rats until the pressure was 100 mm Hg. The skin was irradiated locally with soft x rays. After about 1 sec the pressure falls. To determine if oxygen was involved in the pressure drop, the same experiment was done on rats anesthetized with nembutal, and killed in a plastic box where a slight pure nitrogen pressure was maintained. The oxygen dissolved in the solution was carefully removed. The effect of x radiation was the same as when no precautions were taken to exclude oxygen. Tryptamine inhibits the pressure fall. (J.S.R.)

15860

CORTICOSTEROIDS AND THE RADIATION EFFECT IN REGENERATING LIVER OF THE RAT. J. T. Hemingway (Univ. of Cambridge, Eng.). Experientia 15, 189-91 (1959).

The speed of regeneration of the liver of adrenalectomized irradiated rats is compared to that of normal rats, irradiated with lead shields over pituitary and adrenal, to determine if the secretion of corticosteroids is in part responsible for the radiation-induced inhibition of mitosis. It is shown that the adrenalectomized rat has a mitosis speed four times greater than that of the normal rat in spite of radiation damage to the liver. (tr-auth)

15861

CHARACTERISTICS AND SIGNIFICANCE OF THE ELEMENTARY HEMATOPOIETIC FUNCTION AS RE-

VEALED IN SPLEEN TISSUE OF LETHALLY-IRRADIATED FROGS. M. Hill and M. Praslicka (Univ. of Brno and Faculty of Medicine in Košice, Czechoslovakia). Exptl. Cell Research 17, 214-17(1959) May.

Hematopoietic destruction in the spleens of frogs irradiated with 10,000 r is not prevented by keeping them at low temperature. The fact that their death is delayed is closely associated with maintenance of the elementary function of the hematopoietic tissue, that is the transformation of reticular cells into blast cells and/or preservation of the cytological characteristics of blast cell immaturity. Generally, these events are closely related to the presence of cell debris which, in this case, is supplied by the secondary dissolution of the newly formed blast cells. (auth)

15862

SYNCHRONIZED BUDDING OF YEAST CELLS FOLLOWING X-IRRADIATION. E. Spoerl and Della Looney (U. S. Army Medical Research Lab., Fort Knox, Ky.). Exptl. Cell Research 17, 320-7(1959) May.

Yeast cells, following a continuous 180 minute treatment with x radiation which inhibited cell division but not growth, resumed budding in a synchronous fashion. Though budding was resumed, cell separation did not occur, and consequently, groups of four cells resulted from budding of the paired cells typical of the stage of inhibited division. A second budding produced still larger cell groups. Measurements of the uptake of radioactive phosphorus by division-inhibited cells and by cultures with 80 per cent of the cells ready to bud showed a greater uptake per unit of dry weight by the inhibited cells. The total phosphorus and the phosphorus content of various separated fractions were higher in inhibited cells than in cells ready to bud. Insoluble polyphosphates of inhibited cells showed an accelerated uptake, while soluble polyphosphates took up radioactive phosphorus at a slower rate. Nucleic acids showed no reduced uptake. These phosphorus differences, including the possible specific involvement of polyphosphates in budding processes, are considered as leads in uncovering the specific reactions affected by radiation in the processes of cell division. (auth)

15863

DYNAMIC ASPECTS OF A METHOD IN TRACER KINETICS. P.-E. E. Bergner (Karolinska Institutet, Stockholm). Exptl. Cell Research 17, 328-35(1959) May.

The theoretical aspects of tracer kinetics are discussed. Particular interest is devoted to problems concerning the metabolism of ions, especially the bone seeking ones. Some principles of compartment analysis are formulated. (auth)

15864

THE EFFECT OF IONIZING RADIATION ON THE ALLERGENICITY OF MILK PROTEIN. H. F. Kraybill, R. O. Linder, et al. (U. S. Army Medical Research and Nutrition Lab., Denver). J. Dairy Sci. 42, 581-8(1959).

A 9.30 megarad irradiated milk sample produced a response which was 85% that of raw skim milk. The mean cross challenge response for this sample was 19.4% as compared with zero for raw skim milk. Samples exposed to lower doses of radiation produced larger initial responses and lower cross challenge responses as shown by uterine strip contractions of milk sensitized guinea pigs. The importance of reducing the allergenic properties of irradiated protein is discussed. (auth)

15865

THE PROPERDIN SYSTEM IN ACUTE RADIATION SICKNESS. A. A. Bagdasarov, I. L. Chertkov, M. O. Raushenbach, N. L. Samoilina, and Z. I. Sheremet (Order of Lenin Inst. of Hematology and Blood Transfusion). Med. Radiol. 4, No. 4, 3-10(1959) Apr. (In Russian)

In acute radiation sickness in dogs, mice, guinea pigs, and rats, caused by total x irradiation in the dose of LD 75 to 100, a drop of the properdin level was observed in the second half of the disease, usually several days before the death of animals. In the surviving dogs, as a rule, no drop of the properdin level in the blood was noted. In the surviving dogs, as a rule, no drop of the properdin level in the blood was noted. In rabbits affected with acute lethal radiation sickness there was seen no decrease of the properdin system activity. The properdin titer in monkeys usually decreased soon after the irradiation; the activity of the properdin system was not restored even after full clinical recovery. On the basis of experimental data it is surmised that the drop of the properdin level in the blood in acute radiation sickness can be explained by its combination with mucopolysaccharides, which were freed from tissues in the process of development of the disease. (auth)

15866

THE CHANGE OF VASCULAR PERMEABILITY AND CAPILLARY FRAGILITY IN RELATION WITH HEMORRHAGIC PHENOMENA IN RABBITS FOLLOWING THE ACTION OF IONIZING RADIATION. N. I. Arlashchenko. Med. Radiol. 4, No. 4, 10-16(1959) Apr. (In Russian)

The sharpest increase of vascular permeability following irradiation of rabbits (1,000 r) takes place in the first hours after irradiation. At this time there is a sharp increase of quantity of the intravenously introduced fluorescin in the anterior chamber of the eye, as compared to normal conditions. The resistance of capillaries of the rabbit's small intestine in relation to the rate of external pressure, causing hemorrhages in the intestinal wall, drops more considerably at late stages of radiation sickness. The period of largest changes of vascular resistance coincides with the time of appearance of hemorrhages in internal organs of the animal. (auth)

15867

THE STUDY OF NERVOUS MECHANISMS OF THE HIGHER NERVOUS ACTIVITY DISTURBANCE OF WHITE RATS IN THE EARLY STAGE OF ONTOGENESIS IN THE ACTION OF A SINGLE DOSE OF IONIZING RADIATION. A. P. Chesnokova (Inst. of High Nervous Activity, Academy of Sciences, S.S.S.R.). Med. Radiol. 4, No. 4, 16-21(1959) Apr. (In Russian)

The higher nervous activity disturbance of white rats, subjected to radiocobalt irradiation (50 r), in the first day of life and at the age of 18 to 20 days was studied. The results were compared with those of control animals of the same age. In all animals irradiated in the early stage of ontogenesis there is seen a decrease in the process of excitation and inhibition, as well as disturbance of the circuit function of the cerebral cortex in animals irradiated in the first day of life. No disturbances of the general development were observed in animals irradiated in the early stages of ontogenesis as compared with the control group. A leukocytic reaction of the peripheral blood to irradiation was noted in animals irradiated at the age of 18 to 20 days. The irradiation of newborn animals did not effect any change in the leukocyte count. (auth)

15868

THE INFLUENCE OF X-RAY IRRADIATION ON CERTAIN PORTIONS OF THE PERIPHERAL SYSTEM IN RATS. Jan Gromada and Pshemisl Polachek. Med. Radiol. 4, No. 4, 21-7(1959) Apr. (In Russian)

Microscopic investigations of nerve fibers and their endings in 25 adult rats subjected to single irradiation in the dose of 2,400 r were conducted. Nerve fibers of the joint sac, atrial septum and the intestinal wall were under study. Staining was performed with silver according to Bilshovsky-Gross in Lavrentiev's modification; in 2 rats methylene blue was employed. In 4 hours following the irradiation morphological phenomena could be revealed, which testify to the state of extreme irradiation. In 24 hours there are fewer changes. They appear again in a large degree upon survival of the animals up to 72 hours. The changes are quite expressive on nerves of the joint sac, and to a lesser degree in the atrial septum; least of all they are marked in the intestinal wall. The changes are not specific. They are noted also after other procedures. In an insignificant number they are observed in normal conditions, undoubtedly, independent of the state of irritation. Only a part of fibers and endings are affected, the other part always remains unchanged. Changes in the joint sac, atrial septum and intestinal wall testify to the fact that there are primary injuries of the nerve tissue. It can be assumed that the morphological changes in fibers and receptors may be manifested in the reception and in conductors of reflex processes, appearing in irradiated tissues. (auth)

15869

OXYGEN CONSUMPTION BY RATS WITH CHANGED RADIORESISTANCE DURING THEIR IRRADIATION WITH X-RAYS. I. S. Belokonskii. Med. Radiol. 4, No. 4, 27-31(1959) Apr. (In Russian)

Oxygen consumption in rats protected with aminoethylisothiouronium, betamercaptoethylamine, and sodium nitrite, in contradistinction to intact animals does not increase during the irradiation. Apparently, the protective effect of the above-mentioned chemical substances is closely dependent upon their ability to decrease the oxygen consumption by the animals. In rats with an elevated resistance to ionizing radiation, attained by chronic acclimatization to hypoxia, and in those with a lowered radiation resistance, accomplished by preliminary chronic acclimatization in conditions of increased barometric pressure, as well as in intact rats during x irradiation, the oxygen consumption rises by 28 or 29%. The changed sensitivity to radiation does not affect the oxygen reaction during the irradiation. (auth)

15870

THE EFFECT OF STREPTOMYCIN AND PENICILLIN ON THE INFLAMMATORY PROCESS IN IRRADIATED ANIMALS. V. F. Sosova. Med. Radiol. 4, No. 4, 31-6 (1959) Apr. (In Russian)

The importance of the mode of introduction, the number of administrations and the dose of the antibiotic (penicillin and streptomycin) in the treatment of infectious inflammation in irradiated rabbits (800 r) was studied. In the treatment of skin inflammatory foci, caused by the infection with B. coli, intramuscular administration of streptomycin was ineffective. The introduction of the antibiotic into the focus of inflammation reduced the number of microbes, the effect depending upon the quantity of bacteria in the tissue of the focus and on the dose of the antibiotic. In a number of instances upon introduction of streptomycin into the focus there developed very rapidly (in 24 hours) resistant forms of bacteria. (auth)

15871

THE INFLUENCE OF CHRONIC CONTINUOUS ACTION OF IONIZING RADIATION ON THE IMMUNITY. P. N. Kiselev and P. A. Buzini (Central Scientific Research Roentgenology Inst., Ministry of Health, S.S.S.R.). Med. Radiol. 4, No. 4, 36-44(1959) Apr. (In Russian)

Studies are presented of the influence of chronic radiocobalt irradiation (low doses) on the state of natural immunity and the process of immunogenesis. The data elucidate to a certain degree the development of changes, due to ionizing radiation, which occur in the humoral immunity. However, the development of these changes is closely linked with disturbance of the cellular immunity. (auth)

15872

THE INFLUENCE OF LOW DOSES OF IONIZING RADIATION ON THE COURSE OF DYSENTERIC INFECTION. E. K. Dzhikidze and A. S. Aksenova (Academy of Medical Sciences, U.S.S.R.). Med. Radiol. 4, No. 4, 44-50(1959) Apr. (In Russian)

Studies of the influence of chronic action of low doses of x rays on the course of latent dysenteric infection are presented. Monkeys, carriers of dysenteric bacteria for a long period of time, were subjected to x irradiation in the dose of 5 to 7 r daily (until their death). The animals died in 7 to 14 months, the total dose being 785 to 2060 r. The cause of the animals' death was due to infectious complications: activization of latent dysentery in macaco, and pneumonia and laryngitis in baboons. Marked species exhibit specific differences in the sensitivity to dysenteric infection. Macaco monkeys perished from dysentery, which developed on the ground of radiation sickness; in baboons no clinical or pathomorphological manifestations of dysentery were observed. (auth)

15873

THE STATE OF RAT'S TESTICLES IN LOCAL IRRADIATION AND IN RADIATION SICKNESS. B. A. Fedorov. Med. Radiol. 4, No. 4, 50-7(1959) Apr. (In Russian)

Investigations were conducted on the state of testicles in radiation sickness and in their local irradiation revealed a common regularity in the development of the affection. In both instances the composition of seminal ducts and the weight of testicles changes in a definite sequence. Spermatogonia are the first to disappear (on the 15th day following irradiation), then spermatocytes (20th day), spermatids (25th day) and last of all spermatozoids (30—35th day). The change of weight of testicles runs a parallel course with the development of structural changes. (auth)

15874

THE BIOLOGICAL ACTION OF RADIOBARIUM. Yu. I. Moskalev and V. N. Streltsova. Med. Radiol. 4, No. 4, 57-60(1959) Apr. (In Russian)

The specificity of radiation sickness in parenteral administration of various doses of radiobarium (Ba^{140}) was studied in experiments on rats. Values of acute (LD 50/30 = 1.97 μc/gm) subacute (LD 50/120 = 1.42 μc/gm) and chronic (LD 50/360 = 0.91 μc/gm) doses were established. Acute radiation affection provoked by Ba^{140} is characterized by the development of a comparatively brief agranulocytic syndrome and hypochromic anemia, hemorrhagic diathesis, degenerative changes of parenchymatous organs, and early suppression of spermatogenesis. The subacute stage is characterized by the prevalence of restorative processes in the hematopoietic organs, effecting the normalization of peripheral blood picture (40th—50th day), atrophic changes of parenchymatous and generative organs, and the appearance of nonspecific inflammatory processes of bacterial nature. In the chronic form of affection benign and malignant tumors (chondrosarcoma of the femur, papilloma of the urinary bladder and leukemia) develop in a number of animals. (auth)

15875

MORPHOLOGICAL CHANGES IN THE TISSUES FOLLOWING INTRA-TISSUE INTRODUCTION OF RADIOGOLD (Au^{198}). M. I. Svetlakov and V. A. Odinokova (Moscow Regional Scientific Research Chemical Inst. and Central Inst. for Advanced Training for Physicians, Moscow). Med. Radiol. 4, No. 4, 61-4(1959) Apr. (In Russian)

An investigation was made of the morphological changes which develop in tissues of patients with cancer of the larynx at the site of introduction of radiogold (20, 40, 108 mc). Analysis of 15 observations shows that the introduction of radiogold directly into the cancer tumor tissue provokes necrosis with subsequent development of focal sclerosis. In these tissues acute circulatory disorders and dystrophic changes occur, the degree and character of which is determined by the specificity of tissue structure and the dose of the preparation. (auth)

15876

SPECIFIC FEATURES OF POSTOPERATIVE COURSE AND RADIATION SICKNESS IN DOGS SUBJECTED TO X-RAY IRRADIATION. A. N. Gamaleya, A. A. Gyurdzhian, A. F. Koshkin, F. P. Nekrasov, and P. V. Simonov (N. N. Burdenko Chief Military Hospital). Med. Radiol. 4, No. 4, 64-70(1959) Apr. (In Russian)

The experiments were staged on 34 large dogs. Eleven of them were subjected to x irradiation in doses (600—650 r) provoking a severe course of acute radiation sickness, and subsequent operation—resection of 20 cm of the small intestine. Eleven dogs were subjected only to irradiation and 12 only operated upon. The operation was performed under ether narcosis 4—5 hours following irradiation. Comparison of the clinical picture of these three groups of animals enabled to draw the following conclusions. The results of the operation and the postoperative course in the irradiated dogs did not divulge any noticeable deviation and unfavorable course of the disease as compared to the group, of animals, which were not irradiated. The above concerns only those instances, when the onset of radiation sickness takes place after the healing of the wound—at the end of the first and at the beginning of the second week, which occurred even when high doses of x rays were used, producing lethality in 75—80% of cases. The course of radiation sickness in the irradiated dogs also did not show a noticeable deterioration and unfavorable deviations in comparison with the group of recently irradiated but not operated animals. In dogs subjected to the irradiation and operation the latent period of radiation sickness was of a somewhat longer duration, whereas the leukocyte count and the number of neutrophils in 1 mm^3 of blood are higher than in animals only irradiated but not operated. The obtained experimental data give ground to assume that the typical abdominal operation (resection of a portion of the small intestine) in humans subjected to the action of ionizing radiation can be performed in the next few hours after irradiation without apprehension that the radiation affection will aggravate the postoperative course and results of the operation or that the latter will aggravate the course of radiation sickness. (auth)

15877

THE CHARACTER OF CHANGES IN THE ANTIGENIC STRUCTURE OF PROTEINS IN IONIZING RADIATION. L. A. Zilber and V. A. Artamonova (Gamali Inst. of Epidemiology and Microbiology, Academy of Medical Sciences, U.S.S.R.). Med. Radiol. 4, No. 5, 3-6(1959) May. (In Russian)

In comparing the antigenic structure of rabbit's kidneys, one of which was removed following total irradiation, no effect of ionizing radiation on the antigenic structure of the tissue was found. In similar experiments with the rabbit's liver (a portion of which was removed surgically prior to irradiation) there were noted distinct antigenic changes developing after the irradiation. However, in a number of experiments such changes developed because of the surgical procedure without irradiation. For a final decision of the problem on the action of ionizing radiation on the antigenic properties of proteins, experiments must be performed on animals of pure lines. (auth)

15878

SPECIFIC FEATURES OF SKIN ALLERGIC REACTIONS IN IRRADIATED ANIMALS. G. M. Lvitsyna. Med. Radiol. 4, No. 5, 12-17(1959) May. (In Russian)

The peculiarities in the course of skin allergic reactions in irradiated vaccinated animals were studied. Two types of skin allergic reaction changes were observed: intensification and inhibition. An intensification of skin allergic reactions was noted at the height of radiation sickness in 57% of vaccinated guinea pigs, which were subjected to single x-ray irradiation (100, 200, and 500 r). The intensification of the markedness of the specific allergy depended upon the appearance at this period in irradiated guinea pigs of nonspecific hyperergic reactions. A reduction of the intensity of the intensity of skin allergic reactions was observed in guinea pigs subjected to manifold irradiation with x rays. In acute affection of guinea pigs with polonium (0.1 mc/kg) a sharp inhibition of the allergy took place. (auth)

15879

DIMEDROL IN COMBINATION WITH STREPTOMYCIN AND BIOMYCIN IN THE TREATMENT OF INFECTIOUS INFLAMMATION. V. F. Sosova. Med. Radiol. 4, No. 5, 17-19(1959) May. (In Russian)

Studies on the action of dimedrol and the combination of dimedrol with antibiotics (streptomycin or biomycin) on the development of infectious inflammation in irradiated (800 to 1,100 r) and non-irradiated rabbits, infected intracutaneously with B. coli, are presented. From the fact that in the foci of inflammation the number of microbes did not decrease, hemorrhages and necrosis occurred, and bacteremia developed in the infected irradiated animals, it was concluded that dimedrol did not exert a favorable effect on the development of infection. Dimedrol also did not intensify the action of antibiotics on the microbes in the foci of inflammation. (auth)

15880

MORPHOLOGICAL CHANGES IN EXPERIMENTAL LEPTOSPIROSIS IN IRRADIATED GUINEA PIGS. R. V. Petrov and V. V. Shikhodyrov. Med. Radiol. 4 No. 5, 20-3(1959) May. (In Russian)

A comparison is made of morphological changes in three groups of guinea pigs: recently irradiated, recently infected with leptospirosis, and a group of animals infected after irradiation in the dose of 200 r. A more intensive development of pathological changes, relative to leptospirosis and acute radiation sickness, was noted in the irradiated and infected animals. (auth)

15881

THE PENETRATION OF Sr, Cs, Ru AND Fe THROUGH THE PLACENTAL AND MILK BARRIERS. V. G. Kulikova (Inst. of Biology, Ural Filial, Academy of Sciences, U.S.S.R.). Med. Radiol. 4, No. 5, 23-7(1959) May. (In Russian)

Sr^{90}, Cs^{137}, Ru^{106}, and Fe^{59} penetrate from the mother's body into the fetus through the placenta. It also gets into the offspring with milk during the period of lactation. All the elements which were tested enter the fetus in much lower quantities in the early than in the later stages of pregnancy (in case of Cs, Ru, and Fe during the first 8 to 10 days, and within the first 166 days in case of Sr). The penetration of labelled atoms through the placental barrier is determined mainly by the intensity of growth and organogenesis of the fetus. Sr enters the fetus and milk from the maternal body also during the second pregnancy, and when it is incorporated for a comparatively long time prior to gestation. Considerable penetration of Sr and Fe through the placental and milk barriers is associated with its lesser deposition in the organs and tissues of rats in comparison with the control. (auth)

15882

THE ROLE OF THE HYPOPHYSIS-ADRENAL SYSTEM IN THE ORIGIN OF REACTIVITY CHANGES OF THE IRRADIATED ORGANISM. V. B. Rozen and A. A. Rogov (Lenin Medical Inst., Moscow). Med. Radiol. 4, No. 5, 28-34(1959) May. (In Russian)

The changes of the organism's reactivity following clinical recovery from acute radiation sickness were studied with registration of the activity of the hypophysis-adrenal system. The experiments were staged on 380 white male rats. The changes of the functional state of the "nonspecific adaptation system," occurring after single and repeated x irradiation, are preserved following clinical recovery of rats from radiation sickness. Deviations of the functional activity of the hypophysis-adrenal system depend upon the dosage and the number of irradiations. In instances of moderate increase of incretory activity of the adrenal cortex with preservation of its functional reserves, there is, in clinically recovered animals, a higher resistance to repeated irradiation and to diphtheritic and morphine intoxication. However, if there are signs observed of functional exhaustion of the hypophysis-adrenal system in rats following clinical recovery, their resistance to repeated irradiations, diphtheritic toxin, and morphine decreases. (auth)

15883

THE REACTION OF TESTICLES IN WHITE MICE FOLLOWING WHOLE-BODY CHRONIC GAMMA IRRADIATION WITH Co^{60}. G. M. Ronichevskaya (Central Research X Radiological Inst., Ministry of Health, U.S.S.R.). Med. Radiol. 4, No. 5, 34-7(1959) May. (In Russian)

The injury and the reparative ability of the testicles in white mice following an 8-day and 3 to 3.5-month continuous irradiation with Co^{60} gamma rays (100, 500, and 1,000 r, the dose rate being from 1.1 to 125 r per 24 hours) were studied. In irradiation with doses causing a depression of spermatogenesis, a disappearance of various types of cells of the germinal epithelium was noted at definite periods. This depended upon the biological cycle of development of these cells in the process of differentiation, and permitted the duration of these cycles to be determined. In 8-day irradiation with Co^{60} gamma rays (600 to 1,000 r) the reparative processes appear in the injured testicular epithelium later than after the same doses of irradiation of short duration. Another group of mice was irradiated with a dose of 1,000 r, the duration of irradiation being 3.5 months and the dose rate 8.7 per 24 hours. After a temporary period of depression of spermatogenesis the reparative processes and the partial reestablishment of spermatogenesis was noted 30 days after the beginning of irradiation (although the irradiation was still continued). The second depression of spermatogenesis appeared in 60 days following a more prolonged irradiation. The reestablishment of spermatogenesis against the background of continuing irradiation was evidently caused by the mobilization of compensatory mechanisms. After a 3-month irradiation in the dose of 500 and 100 r no radiobiological effect was revealed in the histological sections of the testicles. This may be due to the important role played by the reparative processes in the testicle, and confirms the role of physiological regeneration as one of the factors decreasing the sensitivity of the tissues in definite conditions of irradiation. (auth)

15884

THE BASAL METABOLISM AND THE MORPHOLOGY OF THE THYROID GLAND IN X IRRADIATION OF ANIMALS. V. A. Kiselenko and E. I. Makovskaya (Kiev Research Inst. of Hygiene, Labor, and Occupational Illnesses). Med. Radiol. 4, No. 5, 38-41(1959) May. (In Russian)

The relationship between the morphology of the thyroid gland and the disturbances of the basal metabolism as a result of the action of ionizing radiation was studied. Investigations were carried out on white rats weighing 140 to 200 gms. The animals were subjected to single whole-body irradiation by x rays with dose rate of 37.8 r/min). 6 rats received 500 r each, 4 rats, 800 r each and 11 rats, 1000 r each. Basal metabolism was determined in 14 control rats. It was established that the basal metabolism is always decreased after irradiation with large doses of x rays. Dystrophic and necrobiotic changes of various degrees are revealed in the thyroid gland which depend on the dose of irradiation. (auth)

15885

THE INFLUENCE OF THE SUPRARENALS ON THE HIGHER NERVOUS ACTIVITY AND HEMATOLOGICAL INDICES IN IRRADIATED RATS. A. A. Grafov. Med. Radiol. 4, No. 5, 42-8(1959) May. (In Russian)

Studies on the influences of the suprarenals on the higher nervous activity of irradiated rats (800 r) are reported. The reactivity of the cerebral cortex and hematological indices, which enter into the general adaptation syndrome were investigated. It was established that disturbances of conditioned reflex connections depend upon the typological peculiarities of the higher nervous activity and the presence or absence of suprarenals in the experimental animals. The intensity of the stimulating and inhibitory process and the hematological indices decreased more rapidly in adrenalectomized irradiated rats in comparison with intact irradiated animals with similar typological peculiarities of the higher nervous activity. The use of functional loading after the irradiation caused a sharper reduction of the intensity of principal nervous processes in adrenalectomized rats. The similarity of higher nervous activity disturbances, due to the action of different pathogenic stimuli, gives basis to the assumption that the reactivity of the cerebral cortex pertains to the nonspecific general reactions. The data obtained testify to the fact that the hypophysis and suprarenals are not the only regulating system in the execution of general reactions of the body. (auth)

15886

THE INFLUENCE OF THE RADIATION DOSE ON THE BIOLOGICAL EFFECT. L. B. Koznova. Med. Radiol. 4, No. 5, 48-52(1959) May. (In Russian)

The influence of the dose of radiation on the biological effect was studied by comparing the injurious effect of x rays (1.3 r/sec and 130 r/sec). The experiments were staged on 768 white male rats. The irradiation was carried out on a specially constructed four-tube x-ray apparatus. Doses from 390 to 1300 r were employed. In a definite range of doses (from 390 to 780 r) a lower biological effect of radiation was revealed. It is concluded that high doses (910 r and higher) act differently on the biological effect of irradiation. (auth)

15887

EXPERIMENTS ON THE DISTRIBUTION OF Ce^{144}. Yu. I. Moskalev. Med. Radiol. 4, No. 5, 52-8(1959) May. (In Russian)

Data on the distribution of Ce^{144} in rats in intravenous, subcutaneous, and peroral administrations are presented. In intravenous introduction the largest portion of cerium is deposited in the liver (up to 65%) and skeleton (up to 39%). Ce^{144} is excreted almost exclusively with the feces. It is slowly and in small quantities (14.4% in 16 days) absorbed from the subcutaneous cellular tissue. In subcutaneous introduction, as distinct from intravenous administration, relatively large amounts of Ce^{144} are found in the skeleton and kidneys, and less in the liver, spleen, suprarenals, and bone marrow. 0.03% of Ce^{144} introduced is absorbed from the intestine. (auth)

15888

SPECIFIC FEATURES OF BETA-RADIATION IN WORK WITH URANIUM. O. S. Andreeva and M. I. Lebedev. Med. Radiol. 4, No. 5, 58-62(1959) May. (In Russian)

New data on the change of intensity of beta radiation in the casting of uranium as a result of redistribution of beta-active products of UX$_I^{234}$ and UX$_{II}^{234}$ decay and increase of surface beta activity in thermal treatment are reported. As a result of experiments performed, it was revealed that recently obtained bars of metallic uranium with slag residue may be the source of beta-irradiation (60 to 160 (beta particles/cm^2/sec)) of workers. In the immediate vicinity of the surface of the metal (0.3 to 0.4 m) the radiation intensity reaches 200 to 570 (beta particles/cm^2/sec). After cleaning the surface of the bars and removal of slag the activity drops by 40 to 60%. The investigations have also exposed a possibility of beta-active products of uranium decay entering the slag, which may also be a potential irradiation hazard. Subsequently the slag activity diminishes by 50% in 3 to 5 weeks, which corresponds to the period of UX$_I^{234}$ half-life (Th^{234})—T = 24.5 days. Special attention is to be paid to data on the possibility of beta-active products of uranium decay entering the body along with dust. The activity of air filters was assessed. The content of beta-active aerosols in the premises was within the limits of 8.3×10^{-13} to 6.2×10^{-12} c/l. Recommendations for the improvement of sanitation measures are presented. (auth)

15889

THE CHRONIC ACTION OF SMALL QUANTITIES OF RADIOACTIVE ZIRCONIUM (Zr^{95}) ON THE ORGANISM OF ANIMALS. M. G. Tikhaya. Med. Radiol. 4, No. 5, 62-7(1959) May. (In Russian)

The experiments were conducted on dogs. Zr^{95} (0.2 μc/kg body weight) was introduced to animals with food daily (except Sundays) for 17 months. A number of dogs were under observation for 33 months, i.e., 16 months following cessation of zirconium administration. Radioactive Zr^{95} was diluted in 0.25 N oxalic acid. Toxicity indices were the general state of the animals, weight dynamics, and peripheral blood picture. The Zr^{95} excretion with urine and feces was determined periodically. No pronounced clinical manifestations of the affection were established. Zr^{95} is excreted periodically in small quantities. The disturbance of erythropoiesis is small. Comparatively large changes were seen in leukopoiesis, first expressed by sharp fluctuations of the number of leukocytes and neutrophils, followed later by a progressive decrease. Considerable changes were noted in the lymphoid system: sharp fluctuations followed by a diminution of the lymphocyte count. The impaired functions of leuko- and lymphopoiesis were not restored even in 16 months following the cessation of Zr^{95} administration. (auth)

15890

MORPHOLOGICAL CHANGES OF BONE TISSUE IN ACUTE AND SUBACUTE PLUTONIUM POISONING. N. N. Litvinov. Med. Radiol. 4, No. 5, 68-72(1959) May. (In Russian)

Experiments were conducted on 70 white rats who received intraperitoneally plutonium-239. Considerable changes were seen in the bone tissue upon administration of 0.15, 0.08, 0.04, and 0.02 μc/gm body weight. The changes were most pronounced in the long bones and had a definite sequence of development. In the first days following the administration of plutonium there was an increase of bone resolution with development of cellular-fibrous tissue containing a large quantity of osteoblasts. After the second week a gradual inhibition of the processes of enchondral ossification ensued, with reconstruction of the bone and a drop of the amount of osteoblasts. At the height of affection (3 to 5 weeks) total inhibition of the processes of osteogenesis with death of osteogenic tissue was observed. In animals receiving plutonium with specific activity of 0.04 and 0.02 μc/mg body weight, the disturbance of osteogenesis was marked to a lesser degree than in introduction of 0.15 and 0.08 μc/gm; in the second month the growth of bones was restored to a certain extent. The formation of a large quantity of immature bone tissue was seen in the metaphyses and diaphyses. At the end of the third month premature cessation of the bone growth took place. The amount of immature bone in various portions of the skeleton increased. (auth)

15891

THE EFFICACY OF CERTAIN COMPONENTS IN CAUSAL TREATMENT OF ACUTE Y^{91} INTOXICATION. L. A. Il'in. Med. Radiol. 4, No. 5, 72-6(1959) May. (In Russian)

The effect of benzhydrylaminodiacetic, benzylamindiacetic, parafucsinhexaacetic, and hexamethylendiacetic acids on the acceleration of Y^{91} excretion from the organism of white mice was studied. No positive effect from the use of the above agents was observed. Ethyldiamintetraacetic acid possesses a pronounced stimulating action on the excretion of Y^{91} from the organism of white mice. (auth)

15892

RADIATION EFFECTS DURING PHYSICAL EXERTION OF ANIMALS. K. V. Ivanov, V. V. Perelygin, V. P. Malikhov, and E. A. Pal'mov. Med. Radiol. 4, No. 5, 84-5(1959) May. (In Russian)

An attempt was made to determine the effects of physical exertion during exposure to ionizing radiation. The tests were carried out with one group of white rats, continuously swimming in 21 to 23°C water with a load of 8 g (lead plate attached to their bodies) and exposed to 940 r for 10 min and with a second group under the same conditions exposed to 611 r for 6½ min. The rats of the first group perished after 4 to 6 days, identical results were obtained for control rats exposed without any load or work. The general condition of the swimming rats differed from the control rats in breathing rate, submission to handling, etc. The results of the tests with the second group showed that the rats exposed to 611 r for 6½ minutes perished after 5 to 13 days while control rats perished after 4 to 12 days. (R.V.J.)

15893

THE COURSE OF ACUTE RADIATION SICKNESS IN RATS AT THE PERIOD OF THEIR TRANSFER TO INDEPENDENT FEEDING. V. V. Kholin. Med. Radiol. 4, No. 5, 85-7(1959) May. (In Russian)

Experiments were carried out with 25- to 30-day-old rats in order to determine certain features in the course of radiation sickness in immature mice. The data showed a much lower radio resistance of young rats to 500, 1000, and 2000 r. (R.V.J.)

15894

THE ROLE OF THE SPLEEN IN THE ORGANISM'S REACTION TO IRRADIATION. L. I. Geller. Med. Radiol. 4, No. 5, 87-9(1959) May. (In Russian)

The protective effects of parabiosis and splenectomy of one of the parabion on the survival of rats and rabbits after exposure to 750 to 1000 r and the protective effects of spleen screening of one of the partners in parabiosis on the survival of both partners are discussed. (R.V.J.)

15895

THE GLYCOGEN CONTENT IN THE LIVER OF RATS IN THE FIRST HOURS FOLLOWING IRRADIATION. G. P. Toropova. Med. Radiol. 4, No. 5, 89-90(1959) May. (In Russian)

The rate of glycogen synthesis and decomposition in livers of rats during the first hours following irradiation was investigated. The experiments were carried out with young rats weighing 100 g and mature ones of 200 g. The increase of glycogen level in livers of both groups after exposure was caused by slowed decomposition and increased synthesis of glycogen. Alterations in the glycogen exchange occurred immediately after exposure to lethal doses of filtered and non-filtered x radiation. The observed increase of glycogen acts as a protective measure and indirectly indicates the early appearance of toxic matter after exposure. (R.V.J.)

15896

TRACER METHOD EXAMINES HUMAN BLOOD CIRCULATION. R. Hobart Ellis, Jr. (Nucleonics, New York). Nucleonics 17, No. 7, 56-9(1959) July.

A method using tracer techniques to examine human blood is described. Injecting tracer into a vein and sampling from an artery makes it possible to measure cardiac output. Studying the counting rate as a function of time often reveals abnormalities of the heart. Idealized and experimental counting curves are shown. (A.C.)

15897

RECOVERY IN STATIONARY-PHASE PARAMECIA FROM RADIATION EFFECTS LEADING TO MUTATION. R. F. Kimball, Nenita Gaither, and Stella M. Wilson (Oak Ridge National Lab., Tenn.). Proc. Natl. Acad. Sci. U. S. 45, 833-9(1959) June.

Previous work with exponentially growing paramecia led to the hypothesis that part of the recessive lethal and other deleterious mutations induced by radiation in Paramecium aurelia comes from premutational damage that is subject to loss up to a terminal event, about midway through the interdivision interval. At this time the remaining damage leads to mutation. The present studies show that, during the stationary phase, loss of radiation-induced premutational damage continues until a lower limit, possibly mutation induced at the time of irradiation, is reached. The data unequivocally demonstrate loss of premutational damage; this phenomenon had previously been inferred on somewhat equivocal grounds. They also support the earlier conclusion that the terminal event is something in the normal development of growing cells since there is no evidence for such an event in nongrowing cells. It is suggested that loss of premutational damage is a metabolic process, possibly involving repair, since the rate of loss is much lower in the stationary phase than in exponential growth. (auth)

15898

CHROMOSOME BREAKAGE PRODUCED BY TRITIUM-LABELED THYMIDINE IN TRADESCANTIA PALUDOSA. Donald E. Wimber (Brookhaven National Lab., Upton, N. Y.). Proc. Natl. Acad. Sci. U. S. 45, 839-46(1959) June.

The fragmentation of chromosomes in the root tips of Tradescantia paludosa as produced by tritium-labeled thymidine was measured. As many as 31 fragments per 100 cells occurred in roots grown for 4 to 8 hours in 1 or 2 μc/ml H^3-thymidine and then transferred to isotope-free solutions for further growth before collection. The highest fragment frequency could be correlated with the period during which the maximum amount of H^3-thymidine was incorporated into the chromosomes. Up to 72 fragments per 100 cells at anaphase were demonstrated after continuous exposure of root tips to 1 μc/ml H^3-thymidine for times up to 56 hours. The mitotic index dropped sharply in roots that had been exposed to 1 μc/ml of H^3-thymidine for periods over 8 hours. Cells that absorb large quantities of H^3-thymidine as indicated by autoradiographs are seemingly disturbed in their development and are delayed or prevented from entering mitosis. Autoradiographs of roots that had been exposed to 1 μc/ml H^3-thymidine for 24 to 56 hours showed that the average grain count over dividing nuclei increased as the fragmentation appearing at anaphase increased. Approximations of the dose delivered to the nuclei by the endogenous radiation from the tritium were made by two different methods; however, the estimates showed poor agreement. Confident calculations of the dose probably await the determinations of the efficiency of the β rays in producing an autoradiograph. These findings would indicate that investigators utilizing tritiated substances should interpret their results with caution for the endogenous radiation delivered to a cell may be great enough to cause considerable chromosome breakage and presumably other forms of genetic damage as well as significant changes in cellular physiology. (auth)

15899

THYROID RADIATION DOSES FROM FALLOUT. E. B. Lewis (California Inst. of Tech., Pasadena). Proc. Natl. Acad. Sci. U. S. 45, 894-7(1959) June.

On the basis of published data on iodine-131 levels in cow's milk during a 16-month period ending September 1958, the thyroid glands of average infants and children in the U.S. are estimated to have experienced over the last few years annual doses of about 0.1 rad to 0.2 rad from the radioiodine in fall-out. These doses are roughly one to two times the annual dose to such organs from natural background radiation. For a number of reasons, individual thyroid dose rates from fall-out are expected to show wide deviations from the average rate. (auth)

15900

CELLULAR RADIOBIOLOGY. L. H. Gray (Mount Vernon Hospital, Northwood, Eng.). Radiation Research Suppl. No. 1, 73-101(1959).

It is postulated that exposure of a cell to ionizing radiation directly affects only a very small fraction of the molecules of which it is composed. Cellular disturbances at the molecular level and the chemical changes which follow are reviewed. The influence of radiation quality, the influence of environmental factors at the time of irradiation, and physiological factors which affect recovery phenomena are discussed. (C.H.)

15901

RADIOBIOLOGICAL MECHANISMS OF GENETIC EFFECTS—A REVIEW OF SOME CURRENT LINES OF RESEARCH. L. Ehrenberg (Univ. of Stockholm). Radiation Research Suppl. No. 1, 102-123(1959).

Radioinduced changes in nuclear material and particularly those leading to genetic consequences are reviewed. The induction by radiation of gene mutations and other changes in the gene material, chiefly chromosome breaks, are discussed in detail. Topics discussed include the chemical nature of the genetic material, the dependence of radiation-induced mutations on dose, the relation of target and gene size, the influence of ion density, the substructure of the gene, the specificity of mutagenic agents, back mutation, the sensitive stage for the induction of mutation, the radiomimetic effects of oxygen, and modifying factors which are capable of exerting influences on widely different radiobiological effects such as gene mutation, chromosome rearrangement, growth inhibition, and death of cell or organism. 153 references. (C.H.)

15902

SOME ASPECTS OF MAMMALIAN RADIOBIOLOGY. R. H. Mole (Medical Research Council, Harwell, Eng.). Radiation Research Suppl. No. 1, 124-48(1959).

Data collected to date on the delayed effects of radiation exposure on human populations are reviewed. The problems of assessing hazards to man are discussed. Other topics discussed include the mechanisms of primary radiobiological lesions, the biological effects of large single doses, modifications by chemical pretreatment, the precision of the acute lethal response, the radiation chimera, recoverable and irreversible damage, and delayed effects of radiation. 93 references.

15903

NATURAL AGING AND THE EFFECTS OF RADIATION. Alex Comfort (University Coll., London). Radiation Research Suppl. No. 1, 216-34(1959).

Neither studies of occupational exposure nor military experiments, deliberate and accidental, have yet yielded satisfactory evidence on the long-term effects of radiation on individual human aging or on the life span of human populations. Natural aging is defined as a progressive decline in vigor with increasing age, which is probably universal in warm-blooded vertebrates. The mechanisms which bring about mammalian aging are wholly unknown, and it can be discussed only in the most general descriptive terms. It is not known whether the loss of vigor occurs at a cellular or a tissue level, whether there is a timekeeping process common to all mammals, or whether aging is an assembly of processes whose only common property is that they increase vulnerability. Results of studies on rats give some evidence that aging may be dissociable from general metabolism. Results are reviewed from a number of studies on animal survival in which factors other than radiation are considered. Data are summarized from a number of studies on the long-term effects of irradiation on life span. Survival curves of control and irradiated animals are compared. All the experimental studies indicate that ionizing radiations, at least above a certain threshold of exposure, shorten life. It is pointed out that the observations are difficult to compare because of their heterogeneity in type, relative efficiency, variation in methods of radiation dosimetry, choice of animals and strain, methods of analysis, and methods of expressing results. It is also pointed out that mathematical consideration of possible mechanisms in radiation injury has so far outstripped experiment. It is concluded that radiation biology can offer fundamental information about natural aging processes. The author states that sufficient time has now been devoted to experiments in which radiations have been administered to animals and shown to do them no good. This point having been established, it should be possible to fix the requirements for more instructive comparisons. Some areas for future research are suggested. 66 references. (C.H.)

15904

THE LATE EFFECTS OF IONIZING RADIATION: SOME GENERAL PROBLEMS OF EXPERIMENTAL DESIGN. Henry I. Kohn (Univ. of California, San Francisco). Radiation Research Suppl. No. 1, 235-42 (1959).

The term late effect is said to be a convenient label, useful in medicine, public health, and biology, to denote an effect whose appearance occurs at a considerable time after exposure. Little is known about the processes leading to the production of late effects of radiation. It is important that late effects be traced back through successive developmental stages to the initial radiobiologic stage. When the results of such studies become available, a rational system of classification could be devised for late effects, based on common modes of origin and development. An elementary, two-stage model for the production of late radiation effects is presented. After the absorption of ionizing radiation, the events of the first or radiobiologic stage lead within a matter of seconds or minutes to the production of the initial cellular change that results in a series of physical and chemical reactions. The second stage is a purely biologic one in which the initial change develops into a late effect. The initial change modifies the function of the organ in which it occurs and stimulates a reaction on the part of both the organ and the organism which may either diminish that change or enhance its direct and indirect effects. In the case of cells that divide, the change may have genetic consequences. The net result of all these phenomena over a period of time and under particular environmental conditions may be trivial, or may be an observable as late effect. Experimental design involves decisions concerning biologic constitution, radiation dosage, elapsed time between exposure and observation, and the kind of effect to be observed. The use of the force of mortality as the primary measure of radiation injury is questioned. It is postulated that what is needed for radiobiological studies is a measure of the efficiency of living rather than an estimate of the probability of death. (C.H.)

15905

LATE PATHOLOGIC EFFECTS OF ATOMIC DETONATION AND THEIR PATHOGENESIS. J. Furth, A. C. Upton, and A. W. Kimball (Oak Ridge National Lab., Tenn.; Children's Cancer Research Foundation, Boston; and New England Deaconess Hospital, Boston). Radiation Research Suppl. No. 1, 243-64(1959).

Operation Greenhouse was an atomic weapons test which took place in April 1951. During this test genetically uniform animals were simultaneously exposed to the same radiation source. Groups of 220 mice were placed at varying distances from the hypocenter of the detonation, and groups of about 30 mice each were lead shielded for investigation of predominantly fast neutron effects. All mice were individually caged and randomized. All animals were subsequently maintained under similar environmental conditions and observed until natural death. They were autopsied and sectioned when necessary. Data are compared with that obtained from a group of mice exposed under laboratory conditions. The findings are appraised by means of biometric analysis. Findings are summarized and discussed. The data indicate that a split-second exposure to ionizing radiation can trigger a large number of events. These events depend on dose, the species and strain of the animals, and the physiological and environmental factors present at the time of exposure. A schematic sketch illustrates the neoplastic and late non-neoplastic changes caused in mice by whole-body irradiation. Most of the changes observed are detrimental. A few of these have been observed in man and at a lower induction rate. Many have never been recorded in man. Possible reasons are discussed. 30 references. (C.H.)

15906

LATE EFFECTS OF INTERNALLY DEPOSITED RADIOISOTOPES IN LABORATORY ANIMALS. Miriam P. Finkel (Argonne National Lab., Lemont, Ill.). Radiation Research Suppl. No. 1, 265-79(1959).

Radiotoxicity studies with internally deposited isotopes are complicated by the facts that the total dose and the dose rate cannot be controlled and cannot be adequately measured because they vary with time and space. Insoluble materials introduced into the body remain at the site of administration, whereas soluble materials are distributed in accordance with their chemical characteristics. The late effects of moderate and low doses of radioisotopes are reduction in life span and induction of tumors. These responses are influenced by the type and energy of the radiations, by the amount of material that remains in the body, and by the location of the retained material. Comparisons of the effects of intravenous injections of Ra^{226}, Pu^{239}, U^{233}, Po^{210}, Sr^{90}, and Ca^{45} in mice can contribute to an understanding of the many factors involved in the long-term effects of internal emitters. On an injected microcurie basis, the α-particle emitters are more toxic than the β-particle emitters. Radium is the least effective of the former in reducing life span, and its potency as a skeletal carcinogen is less than that of Pu^{239} but slightly greater than that of U^{233}. The differences in effectiveness between injected microcurie doses of Sr^{90} and Ca^{45} are largely due to differences in β-ray energy. In addition to the induction of soft tissue tumors by Po^{210} and the induction of malignant bone tumors by the other isotopes, all influenced the tumors of the blood-forming tissues. Since these neoplasms seemed to be affected by levels of Sr^{90} that produced no change in life span or in number of osteogenic sarcomas, and since they show certain similarities to the human leukemias, they are an important subject for further study. (auth)

15907

EFFECTS OF FALLOUT RADIATION ON A HUMAN POPULATION. R. A. Conard, J. S. Robertson, and W. Wolins (Brookhaven National Lab., Upton, N. Y.); L. M. Meyer (South Nassau Communities Hospital, New York); W. W. Sutow (M. D. Anderson Hospital, Houston, Tex.); and H. Hechter (Naval Radiological Defense Lab., San Francisco). Radiation Research Suppl. No. 1, 280-95(1959).

The status of 82 Marshallese people from Rongelap Atoll is reviewed four years after their accidental exposure to significant amounts of fall-out radiation. The accident occurred after the detonation of a large thermonuclear device during experiments at Bikini Atoll in the Pacific Proving Grounds in March 1954. A description of the clinical status is preceded by a brief summary of the past findings. At four years postexposure, the only remaining evidences of the initial radiation exposure are the lag in complete recovery of certain peripheral blood elements to the levels of a comparison population, the remaining residua of the beta-ray lesions of the skin, and evidence of low levels of radioisotopes absorbed internally. Late effects of radiation exposure were not seen. 20 references. (C.H.)

15908

THE GENETIC AND PHENOTYPIC CHARACTERISTICS OF RADIATION-INDUCED MUTATIONS IN MICE. W. L. Russell and Liane Brauch Russell (Oak Ridge National Lab., Tenn.). Radiation Research Suppl. No. 1, 296-305(1959).

Data are presented on the genetic and phenotypic characteristics of 174 mutations at seven specific loci recovered after irradiation of mouse spermatogonia with three doses of acute x rays. There are several lines of evidence that suggest that mutations induced in spermatogonia are point mutations or very small deficiencies. The most cogent among these is the absence of simultaneous mutation of the closely linked d- and se-loci. Deficiencies involving the d- and se- loci occur spontaneously and can be induced in postspermatogonial stages. Since they have been shown to be frequently capable of passage through meiosis and of transmission, failure to recover them from irradiated spermatogonia is evidence that they are not induced. Marked variation in mutation rates was found among the seven loci. In view of the fact that mutations recovered from irradiated spermatogonia appear to be mostly point mutations, this variation may indicate intrinsic properties of the loci or the closely adjacent regions. The specific locus method has detected a wide range of alleles, from those only slightly different from wild type, through apparent repeats of the test allele, to mutations lethal in homozygous condition. This last class is the most frequent. Since deleterious effects of many of the individual lethals in heterozygous condition have been detected, however, and since unidentified mutations elsewhere in the genome have statistically demonstrable deleterious effects, it seems likely that heterozygous effects will add up to a greater total genetic damage in the population than the effects of homozygotes. (auth)

15909

THE LOAD OF HEREDITARY DEFECTS IN HUMAN POPULATIONS. Alan Carruth Stevenson (Queen's Univ., Belfast). Radiation Research Suppl. No. 1, 306-25(1959).

A study was made of hereditary defects in a population of Northern Ireland. Data were accumulated over a ten-year period. An attempt was made to determine the number and nature of specific hereditary disorders. Difficulties encountered in making such estimates on human populations are discussed. Data are tabulated on the frequency of harmful segregating traits and on the frequency of specified category traits identified in the population. 8 tables. 7 references. (C.H.)

15910

SYMPOSIUM D: ATTEMPTED ANALYSIS AND CORRELATION OF VARIOUS RADIOBIOLOGICAL ACTIONS ON THE SAME KIND OF CELL (YEAST). Introduction to the Symposium. Cornelius A. Tobias (Univ. of California, Berkeley). Radiation Research Suppl. No. 1, 326-31(1959).

Findings are summarized from a number of studies on morphology, genetics, and radiosensitivity of yeast cells. Application of data on yeast radiobiology to the understanding of reaction mechanisms in radiation effects is discussed. 29 references. (C.H.)

15911

INHIBITION OF CELL DIVISION. Thomas H. Wood (Univ. of Pennsylvania, Philadelphia). Radiation Research Suppl. No. 1, 332-46(1959).

The danger inherent in formulating specific models to explain physical-biological phenomena is discussed. Some of the phenomenological observations on effects of ionizing radiations on cell division in yeast are reviewed. Recent observations made on the modification of radiation damage in yeast by various environmental agents are described. These findings are analyzed within the frameworks of the generalized migration model of Zirkle and Tobias and of the modified direct-action model formulated by Alper, Howard-Flanders, Alexander, and others. 34 references. (C.H.)

15912

GENETIC EFFECTS OF RADIATION ON YEAST CELLS AND GENETIC CONTROL OF RADIOSENSITIVITY. G. E. Magni (Università, Pavia, Italy). Radiation Research Suppl. No. 1, 347-56(1959).

The present state of knowledge of the genetic effects of ionizing radiations on yeast is reviewed. Data are presented from recent studies on the genetic components of the lethal action of radiations and the genetic control of radiosensitivity in yeast. 21 references. (C.H.)

15913

BIOCHEMICAL AND PHYSIOLOGICAL CHANGES IN IRRADIATED YEAST. Aser Rothstein (Univ. of Rochester, N. Y.). Radiation Research Suppl. No. 1, 357-71(1959).

The effects of radiation and of certain radiomimetic substances on biochemical and physiological functions in the intact yeast cell are discussed. Mechanisms of radiation effects on yeast and factors affecting radiosensitivity are examined. The relationship of metabolic cycles to cellular structure is considered. It is pointed out that some of the radiation effects on cells may result from interaction with structural elements rather than with enzymes directly. The influence of a statistical effect in results of studies on the radiosensitivity of biological substances is discussed. (C.H.)

15914

THE INFLUENCE OF METABOLISM ON SOME RADIATION EFFECTS. Carl A. Beam (Yale Univ., New Haven). Radiation Research Suppl. No. 1, 372-90(1959).

The radiobiological consequences of some controllable metabolic variables are considered, and an attempt is made to relate them to the biology of the yeast cell. The radiobiological consequences of starvation and of cell division are considered in detail. Evidence and arguments are presented in support of an hypothesis to account for the behavior of the dividing yeast cell. The nature of the proposed invulnerability to radiation damage of the nucleus of the budding yeast cell is discussed. 35 references. (C.H.)

15915

OBSERVATIONS OF MAMMALIAN CHROMOSOME FINE STRUCTURE AND REPLICATION WITH SPECIAL REFERENCE TO MOUSE TESTIS AFTER IONIZING RADIATION. B. R. Nebel (Argonne National Lab., Lemont, Ill.). Radiation Research Suppl. No. 1, 431-52 (1959).

Mouse spermatocytes were observed under electron microscopy during pathobiosis following 1000 r acute localized radiation. The kinetochore regions are larger and more prominent and show more internal structure in x-irradiated material than in control material. The kinetochore region resembles an osmiophile cone at the apical end of the first meiotic metaphase chromosomes in mouse. The base of the cone shows a number of well defined compound eltene helices issuing from the kinetochore and continuing into the body of the chromosome. The number of eltene helices confirms earlier work on coccids. Thus in the mouse also about 64 microfibrillae represent the univalent chromosome, 32 microfibrillae per chromatid. A special study was made of core length and core behavior in meiosis. The over-all length of cores decreases 39% between leptotene and pachytene. (auth)

15916

INTERPRETATION OF INDUCED CHROMOSOME BREAKAGE AND REJOINING. Sheldon Wolff (Oak Ridge National Lab., Tenn.). Radiation Research Suppl. No. 1, 453-62(1959).

Phenomena associated with the induction of chromosome aberrations by ionizing radiations and subsequent rejoining are discussed. The chemical nature of breaks and the biochemistry of rejoining are considered. Topics discussed in detail include the random or nonrandom nature of aberration production, the distance over which an exchange can take place, and the nature of the rejoining process, whether it is physical or chemical. Data are tabulated from studies on Tradescantia, Vicia seed, and barley seed exposed to mutations and various doses of x radiation. 15 references. (C.H.)

15917
EVIDENCE FOR FREE-RADICAL PRODUCTION IN PHOTOSYNTHESIZING SYSTEMS. P. Sogo, M. Jost, and M. Calvin (Univ. of California, Berkeley). Radiation Research Suppl. No. 1, 511-18(1959).

A block diagram is presented of an electron spin resonance spectrometer and optical system. Procedures for operation of the apparatus are described. Applications of the electron spin resonance technique in studies on free radical production in photosynthesizing systems are reported. (C.H.)

15918
THE INFLUENCE OF HIGH ENERGY RADIATION ON COTTON. III. 2-THIOBARBITURIC ACID TEST FOR DEGRADATION. H. Pan, B. E. Proctor, and S. A. Goldblith. Textile Research J. 29, 425-30(1959).

Raw cotton irradiated with cathode rays was found to form color compounds with 2-thiobarbituric acid in acidic solution. The color intensity of the test solution was derived from cellulose and the minor constituents of raw cotton. A test method was evolved from this finding based on the measurement of the absorption at 449 mμ. The color of the test solution is stable and the results of the test are reproducible. The test method is direct and rapid to perform. The results of this test compared well with those of the tests of tensile strength, copper number, and intrinsic viscosity. (auth)

15919
THE PHYSICAL LIMITS OF THE ELIMINATION OF SCATTERED X RADIATIONS BY DIAPHRAGMS. Karl H. Reiss (Siemens-Reiniger-Werke, Erlangen, Ger.). Z. angew. Phys. 11, 184-8(1959) May. (In German)

The effect of scattered-radiation screens for x radiation in medical diagnosis is characterized by small coefficients. The determination of the coefficients on the normal phantom is described. On the basis of a general geometric theory of the diaphragms, the maximum value of the possible selectivity is calculated. The diaphragm practically obtainable does not approach the theoretical value. Technical imperfections are one cause, but another cause is the fact that at sufficiently high energies of the radiation on the diaphragm, self-radiation, and therefore K fluorescence radiation of the absorber layer, exists. Rules for the optimum dimensions of diaphragms are given. (tr-auth)

CHEMISTRY

General

15920 58USB5931-2(Pt.1)
United States Borax Research Corp., Anaheim, Calif.
RESEARCH ON INORGANIC POLYMER SYSTEMS. Quarterly Report [for] October 1—December 31, 1958. Jan. 15, 1959. 64p. Project No. 8-(8-7340). Contract AF33(616)-5931.

Investigations are presented on the chemistry of thermally stable inorganic or semi-inorganic polymer systems showing promise of utility at 1000°F. The bonding systems presently under study are B—B, B—N, and Al—O. The preparation of prototype compounds, investigation of the chemistry of polymerization reactions and preliminary evaluations of thermal stabilities of some monomers and polymers are described. (auth)

15921 AECU-4177
Kellex Corp., New York.
THE CHEMISTRY OF THE REACTION OF URANIUM HEXAFLUORIDE WITH ACTIVATED CARBON. T. P. Wilson, S. C. Schuman, and E. L. Simons. [194?]. Decl. June 10, 1959. 29p. (KZ-5585). $4.80(ph), $2.70(mf) OTS.

The effects of temperature, time and other variables on the rate and extent of reaction between UF$_6$ and various types, grades and particle sizes of commercial activated carbon have been studied experimentally. It is shown that both hydrolysis and reduction of the UF$_6$ occur, the latter more slowly than the former. Reduction leads to the formation of a mixture of fluorocarbons ranging from CF$_4$ to a wax-like material volatile only above 250°C. There is also evidence for the adsorption of UF$_6$ on an undetermined substrate. (auth)

15922 AECU-4239
Massachusetts Inst. of Tech., Cambridge.
EQUILIBRIUM EXTRACTION CHARACTERISTICS OF ALKYL AMINES AND NUCLEAR FUELS METALS IN NITRATE SYSTEMS. Progress Report for Period February 1, 1959—March 31, 1959. (Quarterly Report III). Edward A. Mason and Victor C. Vaughen. Mar. 31, 1959. 16p. For [Oak Ridge National Lab.]. Contract W-7405-eng-26, Subcontract No. 1327. $3.30(ph), $2.40 (mf) OTS.

In studies of equilibrium extraction characteristics of alkyl amines and fuels a program was initiated for investigation of Zr, Ru, Mo, Sm, Nb, Tc, and Ce in that order. Temporary delays are reported in the Zr and Ru programs, and interim work on Mo was started. U extraction studies, undertaken to provide a check on the procedures used for the other metals, were completed. Extraction agitation methods were also studied, and it appears that equally good contacting can be achieved by shaking or stirring. Also, preliminary results on the extraction behavior of Zr, Ru, and Mo are reported. (J.R.D.)

15923 AECU-4243
National Bureau of Standards, Washington, D. C.
PROPERTIES OF RUTILE (TITANIUM DIOXIDE). F. A. Grant. Jan. 15, 1959. 242p. NBS Project No. 0900-11-4475. $37.80(ph), $11.10(mf) OTS.

Titanium dioxide exists in three modifications, anatase, brookite, and rutile. Their pycnometer densities at room temperature are 3.9, 4.12, and 4.22 grams per cubic meter. The other modifications are converted into rutile upon heating to 1000°C. The following properties are discussed: crystal structure, optical and dielectric properties, dielectric constant and loss angle, electric and thermal conductivity, transport phenomena in magnetic fields, magnetic and scattering phenomena, x-ray properties, and thermodynamic properties. A bibliography is included. (J.E.D.)

15924 AERE-AM-5
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE DETERMINATION OF SULPHUR IN MIXTURES OF SODIUM, POTASSIUM AND MAGNESIUM CHLO-

RIDES. E. Booth and T. W. Evett. Feb. 1959. 6p. $0.25(BIS).

The method depends on the wet reduction of sulfur compounds by a mixture of hydriodic and hypophosphorus acids. The resulting hydrogen sulfide is distilled into zinc acetate solution and reacted in the presence of ferric chloride to produce the dyestuff Lauth Violet. The absorbancy of the dyestuff solution is measured at 595 mμ on a spectrophotometer or on a Spekker absorptiometer using Ilford Filters No. 606. (auth)

15925 AERE-A/M-7
United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.
THE DETERMINATION OF PHOSPHORUS IN LOW-GRADE URANIUM ORES. E. Booth. Apr. 1959. 4p. $0.16(BIS).

The ore, after sintering with sodium peroxide, is dissolved in nitric acid. P is determined absorptiometrically as the phosphovanadomolybdic acid complex. The coefficient of variation at 100 ppm is about ±2%. (auth)

15926 AERE-A/M-11
United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.
THE DETERMINATION OF POTASSIUM IN MIXTURES OF SODIUM, POTASSIUM AND MAGNESIUM CHLORIDES. E. Booth and A. Parker. Apr. 1959. 3p. $0.16(BIS).

Potassium is determined gravimetrically as the tetraphenyl boron salt. No sample pretreatment is required. The coefficient of variation at the 20 mg level is about 0.6%. (J.R.D.)

15927 AFCRC-TN-58-561
[New York Univ., New York.]
LITERATURE SEARCH ON SELECTED METAL HYDRIDES. Scientific Report No. 1. Sept. 1958. 115p. Contract AF19(604)-4124. (AD-160870).

This literature search includes 272 references and abstracts from the published literature on metal hydrides. (L.T.W.)

15928 CF-56-7-106(5th Issue)
Oak Ridge National Lab., Tenn.
NEUTRON ACTIVATION ANALYSIS. G. W. Leddicotte and S. A. Reynolds. July 9, 1959. 18p. Contract [W-7405-eng-26].

A description of the ORNL neutron activation analytical service is presented. Techniques and measurement limits are also discussed as well as general applications. (J.R.D.)

15929 CF-58-4-39
Oak Ridge National Lab., Tenn.
OPERATION OF ORNL IN-PILE 5-GPM PUMP WITH THORIUM OXIDE SLURRY. D. W. Hubbard and H. C. Savage. Apr. 15, 1958. 10p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

An ORNL 5-gpm canned rotor pump with aluminum oxide bearings and journal bushings circulated thorium oxide slurry in the concentration range of 600 to 800 g Th per kg H_2O for 642 hr without the use of bearing purge water. Very little bearing wear (0.005 in. on the front bearing and journal thrust surfaces) was observed. The results of this test indicate the possibility of operating an in-pile slurry loop pump, with a particular thorium oxide slurry, without the need of condensate feed to the pump bearings. This would greatly simplify the design and operation of the loop. (auth)

15930 CRDC-843
Atomic Energy of Canada Ltd., Chalk River, Ont.
SOME APPLICATIONS OF X-RAY FLUORESCENCE SPECTROGRAPHY TO THE DETERMINATION OF URANIUM AND THORIUM. R. W. Jones. Apr. 28, 1959. 20p. (AECL-837). $0.50(AECL).

Several methods for the determination of uranium and thorium by x-ray-fluorescence spectrography are described. In pure solutions the sensitivity for these elements is 5 to 10 ppm. For solutions containing gross concentrations of impurities, strontium is added as an internal standard. Precision and accuracy of the determinations are about 1% when working in the optimum concentration range. (auth)

15931 IGO-AM/S-8
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
DETERMINATION OF COMBINED NITROGEN IN NIOBIUM METAL. Apr. 17, 1956. 9p.

The niobium metal is dissolved in a mixture of hot concentrated sulfuric acid, potassium sulfate, and copper sulfate. The ammonia separated by distillation from alkaline solution is determined absorptiometrically using either sodium phenate/sodium hypochlorite reagent for samples containing 5 to 90 ppm combined nitrogen, or Nessler's reagent for samples containing 90 ppm to 0.44% combined nitrogen. For samples containing more than 0.44% combined nitrogen, the ammonia is absorbed in standard acid, excess of which is determined by titration with standard alkali. The method has been used for pure niobium metal containing not less than 5 ppm nor greater than 2.5% combined nitrogen. At the 5 ppm level results show a quantitative recovery with a coefficient of variation of about ± 3%. At the 90 ppm level results show a negative bias of about 5% with a similar coefficient of variation as before, and at 0.2% the results are quantitative with a coefficient of variation of about ± 5%. (auth)

15932 IGO-AM/S-19
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
SPECTROGRAPHIC DETERMINATION OF ALUMINIUM IN U_3O_8. Apr. 5, 1956. 11p.

The sample of U_3O_8 is mixed with 5% of its weight of sodium fluoride. One hundred-mg charges of the mixture are then placed in a graphite cup and excited in a d-c arc at 12 amperes when the sodium fluoride distils accompanied by the aluminum. The arc is aligned with a large quartz spectrograph, and the resultant spectra are evaluated by means of a nonrecording microphotometer. Standard curves are obtained from standard samples spectrographed on the same plate. (auth)

15933 IGO-AM/S-30
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF IRON IN URANIUM METAL. Mar. 29, 1956. 5p.

The metal is dissolved in nitric acid. The thioglycolic acid iron complex is developed in the presence of ammonium carbonate and ammonium citrate and is determined absorptiometrically. The method is suitable for the determination of iron in uranium at a concentration of 0 to 600 ppm. (auth)

15934 IGO-AM/S-41
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF COMBINED NITROGEN IN BERYLLIUM METAL. May 28, 1956. 8p.

The sample is dissolved in dilute sulfuric acid whereby the combined nitrogen is converted to ammonium sulfate. Ammonia liberated from the solution by addition of excess sodium hydroxide solution is separated by steam distillation. The ammonia in the distillate is determined absorptiometrically using sodium phenate/sodium hypochlorite reagent, Nessler's reagent, or by titration depending on the level of combined nitrogen in the sample. (auth)

15935 IGO-AM/S-137
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE ABSORPTIOMETRIC DETERMINATION OF MOLYBDENUM IN URANIUM–MOLYBDENUM ALLOYS. Mar. 3, 1959. 5p.

The sample is dissolved in nitric and hydrochloric acids and diluted to standard volume. An aliquot is heated to fuming, with sulfuric acid, to remove nitrate, and then diluted to a known volume. An aliquot of this solution is made strongly acid with hydrochloric acid and the molybdenum determined absorptiometrically as the dithiol (4-methyl-1:2-dimercapto benzene) complex which is maintained in homogeneous solution by the addition of n-butyl alcohol. (auth)

15936 IGO-AM/S-140
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE ABSORPTIOMETRIC DETERMINATION OF VANADIUM IN URANIUM–VANADIUM ALLOYS. Mar. 3, 1959. 5p.

The vanadium is determined absorptiometrically as the peroxy-vanadium complex without prior separation from the uranium. An aliquot of a nitric acid solution of the alloy is evaporated to dryness and the residue dissolved in a controlled amount of sulfuric acid. The vanadium is first oxidized with potassium permanganate and then with hydrogen peroxide and the absorbancy measured at 5200 A after standing in the dark for an hour. The method is applicable to the determination of vanadium within the range 0.05 to 0.30% in uranium–vanadium alloys. Up to at least 0.2% of iron and 0.4% of molybdenum do not interfere, but chromium does interfere above 0.01%. (auth)

15937 IGO-AM/S-141
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE ABSORPTIOMETRIC DETERMINATION OF SILICON IN URANIUM–MOLYBDENUM ALLOYS (12% MOLYBDENUM). Mar. 3, 1959. 7p.

A portion of the metal in the form of turnings or powder is dissolved in a mixture of nitric and hydrochloric acids, filtered and the insoluble portion treated separately. An aliquot of the solution is added to a mixture of hydrochloric acid and ammonium molybdate. After allowing time for the formation of the silicomolybdate complex, oxalic acid is added to decompose phospho and arseno-molybdates and sodium sulfite to prevent fading of the "molybdenum blue." An excess of sulfuric acid is added to prevent reduction of the molybdic acid and the silicon determined absorptiometrically, after reduction of the complexed molybdenum with stannous chloride. The insoluble residue is fused with sodium hydroxide and after adjusting the acidity, the silicon content is determined by a similar method to that used for the uranic solution. (auth)

15938 IGO-AM/S-147
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE ABSORPTIOMETRIC DETERMINATION OF IRON IN URANIUM TETRAFLUORIDE. Mar. 1, 1959. 5p.

Uranium tetrafluoride is dissolved by boiling with a solution of aluminum chloride in nitric and hydrochloric acids. The tetrafluoride dissolves due to the formation of complex $(AlF_6)^{3-}$ ions, and nitric acid oxidizes the uranium to the hexavalent state. The solution is cooled, and thioglycolic acid/ammonium citrate and ammonia/ammonium carbonate solutions are added. Citrate ions prevent the precipitation of uranium ions in alkaline solution, while carbonate suppresses the absorbancy due to uranium complexes. The iron concentration is measured absorptiometrically as the thioglycolate complex. (auth)

15939 IGO-AM/S-192
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE GRAVIMETRIC DETERMINATION OF SILICON IN THORITE. Feb. 27, 1959. 5p. $0.17(BIS).

The sample is broken down by fusion with sodium hydroxide followed by leaching with dilute nitric acid. The silica is dehydrated by fuming with perchloric acid. The residue is filtered and the silicon determined by weighing the ignited residue before and after treatment with hydrofluoric acid. The method is applicable to Nigerian thorite containing 5 to 10% thorium. (auth)

15940 IGO-AM/S-194
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE GRAVIMETRIC DETERMINATION OF PHOSPHORUS IN MONAZITE SAND (MAGNESIUM PYROPHOSPHATE). Feb. 27, 1959. 6p. $0.21(BIS).

A known weight of sample is fused with potassium hydroxide. The cooled melt is leached with water and filtered. The filter is ashed and fused with potassium hydroxide, water leached, and filtered. The hydroxide solutions are combined and, after neutralization, the phosphate is precipitated as ammonium phosphomolybdate. The precipitate is filtered off and dissolved in ammonia solution. This solution is neutralized and the phosphate precipitated as magnesium ammonium phosphate by the addition of magnesia mixture and ammonia. The precipitate is filtered off and purified by dissolving in dilute acid solution and re-precipitating. The precipitate is filtered off, ignited to magnesium pyrophosphate, and weighed. (auth)

15941 IGO-AM/S-196
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF IRON IN THORITE. Mar. 6, 1959. 5p. $0.17(BIS).

A solution of the sample is obtained by fusion with potassium hydrogen fluoride and then potassium hydrogen sulfate, the cooled melt being leached with dilute nitric acid. The iron is precipitated from alkaline tartrate solution with ammonium sulfide. The ferrous sulfide is separated and dissolved by oxidation in sulfuric acid. The iron is precipitated as hydroxide, separated, and dissolved in hydrochloric acid. The determination is made by reduction with stannous chloride and following the addition of mercuric chloride, titration with standard potassium dichromate solution. The method is suitable for iron contents of 0.2% upwards. (auth)

15942 IGR-TM/S-07
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE SODIUM PHENATE, SODIUM HYDROXIDE METHOD FOR THE DETERMINATION OF AMMONIA. A. B. Crowther and R. S. Large. Nov. 30, 1955. 17p. (IGC-ARDC/P-152).

The absorptiometric method for the determination of ammonia in natural waters was examined to see how far the procedure would be applicable to current requirements. The advantages of substituting the method for the Nessler procedure were considered. Improved conditions are described for developing and reproducing color obtained when sodium phenate and sodium hypochlorite are added to solutions of ammonia. (J.E.D.)

15943 IGO-TM/S-016
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF NITROGEN IN URANIUM: AN INVESTIGATION INTO LOSSES OF NITROGEN. A. B. Crowther and C. R. Johnson. Mar. 14, 1956. 9p.

The solution of uranium metal in hydrochloric and perchloric acids prior to the determination of nitrogen has been investigated, and possible sources of loss of nitrogen have been determined at different stages. The most serious loss appears to be caused by excessive fuming with perchloric acid. The substitution of perchloric acid by hydrogen peroxide does not appear feasible, and the introduction of sulfuric acid as a means of extending the "safe" fuming period is not very practical. (auth)

15944 IGO-TM/S-022
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF BROMINE IN CHLORINE TRIFLUORIDE. A. E. Sawyer and A. R. Spencer. May 8, 1956. 13p. (IGC-ARDC/P-196).

The development of a method for the determination of microgram quantities of bromine in chlorine trifluoride is described. The liquid sample is allowed to vaporize, and the vapor is decomposed by passing through dry sodium chloride, the liberated chlorine being absorbed in potassium hydroxide solution. The mixture of sodium fluoride and chloride is dissolved in the hydroxide solution and the whole diluted to standard volume. Chlorate and hypochlorite are reduced to chloride with sulfurous acid, and the bromide is oxidized to bromate by heating with sodium hypochlorite in buffered solution. Bromate liberates iodine from acidified potassium iodide solution, which is titrated with standard sodium thiosulfate solution using starch as indicator. Lower concentrations of bromine are determined absorptiometrically when the bromate in acid solution is used to oxidize 3-3 dimethyl naphthidine to the intensely colored meriquinonoid compound. The absorbancy of the solution is measured in Perspex cells. Neither method is specific for bromine, but interfering substances are unlikely to be present in chlorine trifluoride. (auth)

15945 LA-2286
Los Alamos Scientific Lab., N. Mex.
THE SYSTEMS UF_4-SnF_2 AND PuF_3-SnF_2. B. J. Thamer and G. E. Meadows. Jan. 1958. 33p. Contract W-7405-eng-36. $1.00(OTS).

The salt SnF_2 melts at 213 ± 1°C and boils at 850 ± 5°C. It is potentially feasible for use in a fuel for a power reactor. Studies of the phase diagram of the system UF_4-SnF_2 have been made by the techniques of filtration, differential thermal analysis, visual observation, and quenching, with identification of the solid phases through chemical analysis and by physical means. Three uranium-containing solid phases are observed, namely, UF_4 and the two secondary compounds, $UF_4 \cdot SnF_2$ and $UF_4 \cdot 2SnF_2$. Each of the two secondary compounds melts incongruently. The eutectic composition and temperature are 0.5 mole % UF_4 and 212°C. The peritectic point at which the compound $UF_4 \cdot 2SnF_2$ melts is at 4.5 mole % UF_4 and 340°C. That for the compound $UF_4 \cdot SnF_2$ is at 7.8 mole % UF_4 and 371°C. The solubility of PuF_3 in SnF_2, which was also investigated, varies from 0.41 mole % at 350°C to 0.63 mole % at 550°C. (auth)

15946 NP-7644
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
MICROSYNTHESIS OF URACIL-2-C^{14}. Report No. 72/V. B. Łucka and A. Szuchnik. Mar. 1959. 8p.

A micromethod for the synthesis of uracil-2-C^{14} of high specific activity was developed. (auth)

15947 NP-7649
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
THE EFFECTS OF NUCLEAR TRANSFORMATION IN THE BROMATES. PART 2. COMPARISON OF THE EFFECTS OF NEUTRON CAPTURE AND ISOMERIC TRANSITION. Report No. 79/V. I. G. Campbell. Apr. 1959. 14p.

The effects of the reaction $Br^{79}(n,\gamma)Br^{80}$ and the isomeric transition $Br^{80m} \rightarrow Br^{80}$ in bromate solutions and crystalline bromates have been compared. As in the case of isomeric transition previously reported, (n,γ) reaction gives rise to an unstable fragment, probably bromite, reducible with methanol in a certain proportion of events. The (n,γ) reaction leads to a more complete disintegration of bromate than isomeric transition, leading to rupture of at least one Br–O bond in all events. Recombination of fragments in crystalline bromates has been compared for the two transformations. (auth)

15948 NP-7697
Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas.
PAPER CHROMATOGRAPHY OF INORGANIC IONS IN NITRATE MEDIA. I. SCANDIUM, YTTRIUM, ACTINIUM AND THE LANTHANIDES. J. Danon and M. C. Levi. 1959. 5p. (Notas de Física Vol. V, No. 7).

The separation of scandium, yttrium, actinium, and the lanthanides by paper chromatography in lithium nitrate media is described. The investigation was based on the extraction of the rare earths by alcohols from nitrate solutions. (auth)

15949 NYO-7443
New York Univ., New York.
TECHNICAL PROGRESS REPORT. Benson R. Sundheim. May 1, 1957. 46p. Contract AT(30-1)-1837. \$7.80(ph), \$3.30(mf) OTS.

The activity of the components of alloys of Na and K are being determined as a function of composition. In the temperature range 200 to 300°C the vapor pressure of each component is being determined by measuring the optical absorption of the vapor at appropriate wave lengths. In the temperature range below 200°C an investigation is being made of a potentiometric method using glass membranes. (W.L.H.)

15950 OMCE-HEF-166
Syracuse Univ., N. Y.
SOLUBILITY OF IRON IN LIQUID LITHIUM. John J. Sand. Aug. 22, 1958. 39p. For Olin Mathieson Chemical Corp. AMC Project No. 7-558C. Contract AF 33(600)-33920.

The solid-liquid system iron—lithium was studied in order to determine the solubility of iron in lithium over the temperature range 200 to 1200°C. The equation which expresses the best estimate of the solubility of iron in lithium obtained from this work is: $S_T^0 = 0.178T - 17.5$, where S_T^0 = the equilibrium solubility of iron in lithium in ppm Fe/Li (parts by weight of iron per million parts by weight lithium) and T = temperature in degrees C. The experimental method used was to heat the iron capsules containing lithium to equilibrium at specific temperatures and then to quench them in a CO_2—oil bath at −30°C. Each quenched iron—lithium sample was analyzed colorimetrically for iron and then by titration for lithium. Traces of iron oxide on the iron capsules and lithium nitride and lithium oxide in the lithium prevented accurate solubility measurements at low temperatures and therefore extrapolation of the data below 700°C was required. (auth)

15951 ORNL-2737
Oak Ridge National Lab., Tenn.
AN ISOPIESTIC INVESTIGATION OF DI(2-ETHYLHEXYL)PHOSPHORIC ACID AND TRI-n-OCTYLPHOSPHINE OXIDE IN n-OCTANE. C. F. Baes, Jr. July 16, 1959. 16p. Contract W-7405-eng-26. \$0.75(OTS).

Isopiestic measurements are presented in which octane solutions of di(2-ethylhexyl)phosphoric acid (DPA) and tri-n-octylphosphine oxide (TPO) are compared with triphenylmethane (TPM)-octane as the reference solution. In the range 0 to 0.2 m the results show deviations up to 10 and 20% from ideal solution behavior of DPA dimer and TPO monomer, respectively. While partial trimerization of DPA (in qualitative agreement with previous iron(III) extraction results for DPA) and partial dimerization of TPO (which is not supported by molar polarization results) can account in part for the results, it is evident that nonspecific nonideal behavior of the solutes is also involved. Practical activity coefficients were estimated on two separate assumptions: (1) $\gamma_{TPM} \equiv 1$, giving $\log \gamma_{(DPA)_2} = -0.5227 m_{(DPA)_2}^{1/2} + 0.420 m_{(DPA)_2}$ and $\log \gamma_{TPO} = -1.168 m_{TPO} + 0.149 m_{TPO}^2$; and (2) $\log \gamma_{(DPA)_2} \equiv -0.6432 m_{(DPA)_2}^{1/2}$ (from iron(III) extraction results), giving $\gamma_{TPM} = -0.737 m_{TPM}$ and $\log \gamma_{TPO} = -1.886 m_{TPO} + 0.245 m_{TPO}^2$. (auth)

15952 ORNL-2758
Oak Ridge National Lab., Tenn.
ORGANIC COMPOUNDS IN FISSION REACTORS. I. THE DISPERSION OF ThO_2 IN NONPOLAR SOLVENTS. W. H. Baldwin. July 16, 1959. 7p. Contract W-7405-eng-26. \$0.50(OTS).

The advantages of the use of organic liquids in fission reactors to minimize corrosion and pressure problems led to a study of the dispersion of thoria and of the solution of thoria and urania in such fluids. This paper deals with the dispersion of thoria in nonpolar solvents (particularly biphenyl), the settled volume being used to determine the degree of dispersion. Benzoic acid (80 g per kg of ThO_2) and uranyl benzoate were among the successful dispersing agents that were adsorbed from solution. A coating that permitted the dispersion of ThO_2 was formed by treatment with Dri-Film. Further papers in this series will deal with thoria and urania dissolved in biphenyl. (auth)

15953 RDB(C)/TN-3
Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.
A THERMODYNAMIC STUDY OF THE REDUCTION OF URANIUM HALIDES. W. G. O'Driscoll and G. H. Chalder. Apr. 28, 1952. 18p.

The possibility of reducing halides by various metallic reducing agents was studied from a thermodynamic point of view. The changes in free energy for the various reductions were examined and an assessment made of those processes which might prove more efficient than the present reduction of uranium tetrafluoride by either calcium or magnesium. Sodium offers favorable theoretical possibilities as a reductant for UF_4, UF_6, or the corresponding chlorides. The hexafluoride and hexachloride offer possibilities as a suitable basic material for any reduction process. Disproportionation of either UF_3 or UCl_3 as a cyclic process should also be examined. (auth)

15954 RDB(C)/TN-36
Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.
THE MAGNESIUM REDUCTION OF URANIUM TETRAFLUORIDE. W. G. O'Driscoll and E. Calvert. May 1, 1953. 28p. (SFPWP/P-5).

Results obtained for the magnesium reduction of UF_4 in pressurized systems and for reductions by magnesium vapor have indicated that the reduction is initiated as a UF_4 solid/Mg vapor reaction. A solid/solid reaction appears to be possible but this is limited in extent by the true contact area of the reactants. The refractory oxides, lime, alumina, magnesia, thoria, zirconia, and beryllia appear to be unsuitable as reactor lining materials, owing to their reactivity with UF_4 at high temperatures. A proposed mechanism for the reduction is described and recommendations based on it are suggested for the operation of the reduction on a production basis. (auth)

15955 RDB(C)/TN-41
Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.
THE SYSTEM URANIUM—OXYGEN: A CRITICAL REVIEW OF THE LITERATURE. K. Q. Bagley and D. S. Oliver. May 7, 1953. 32p.

The literature pertaining to the phase relations, kinetics, and thermodynamic data of the oxygen—uranium system is critically reviewed. Recommendations for further work on this system are presented. (auth)

15956 RDB(Cap)-5155
Gt. Brit. Capenhurst Works, Capenhurst, Ches., England.
VARIATION OF VISCOSITY OF FLUOROCARBON VAPOURS WITH TEMPERATURE. P. T. Nettley and A. N. Spencer. July 3, 1952. 18p. (IPDC/P-108).

The viscosities of fluorocarbon vapors at various temperatures were studied for use in measuring the separation efficiency of membranes. Measurements made to determine the variation of the viscosity of C_8F_{16}, C_7F_{14}, and $C_6F_{11}Cl$ and mixtures of C_8F_{16} and $C_6F_{11}Cl$ with temperature in the range 20 to 80°C are described. The method used consisted of the comparison of the time of flow of a given volume of vapor through a capillary tube with the time of flow of a given volume of air under identical conditions of pressure and temperature. The viscosity of the fluorocarbon was then calculated using the known value for air. (J.E.D.)

15957 SCS-M-21
Gt. Brit. Springfields Works, Springfields, Lancs, England.
DETERMINATION OF FLUORINE IN URANIUM. A. B. Crowther, O. Stokoe, W. J. Gray, and W. J. McCreath. Aug. 3, 1951. 32p. (SCS-M-27).

A tentative method for the determination of fluorine in uranium turnings has been devised. The most suitable method for dissolving the metal for this purpose is by using a mixture of perchloric acid and hydrogen peroxide. The titration of fluorine with thorium nitrate using chrome azurol S as indicator presents no difficulty to the average operator. The addition of hydroxylamine hydrochloride to remove hydrogen peroxide from the distillate does not prevent the titration of small amounts of fluorine. The presence of relatively large amounts of metals forming complex ions with fluorine reduces the efficiency of the fluorine distillation. (auth)

15958 SCS-M-42
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF THORIA IN MONAZITE SAND. Dec. 25, 1953. 8p.

The thorium is extracted with sulfuric acid and, after double precipitation as iodate, the metal is precipitated as oxalate using oxalic acid. The filtered precipitate is ignited and weighed as ThO_2. The residue after the extraction with sulfuric acid is fused with potassium bisulfate and is treated in a similar manner. (auth)

15959 SCS-M-62
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF FLUORINE IN URANYL NITRATE SOLUTION. May 19, 1950. 4p.

The sample is steam distilled in the presence of sulfuric acid. The nitrates and fluorides are evolved as nitric and hydrofluosilicic acids. The fluoride is determined by titration with thorium nitrate solution using chrome azurol S as indicator. (J.E.D.)

15960 SCS-M-96
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF GOLD, PLATINUM AND PALLADIUM IN PITCHBLENDE ORE AND BARIUM SULPHATE CONCENTRATES FROM PITCHBLENDE ORE. Aug. 31, 1954. 11p.

The sample is fused with a silicate flux containing a reducing agent and litharge. The lead button produced is scorified and cupelled leaving a bead of precious metal. The bead is parted with nitric acid and the gold annealed and weighed. The gold is dissolved in aqua regia and combined with the parting liquid and the silver chloride filtered off. Gold is separated by ethyl acetate extraction and palladium by chloroform extraction of the dimethyl glyoxime complex. Platinum is then removed by ethyl acetate extraction after reduction with stannous chloride. The platinum is back extracted with sodium chloride solution and titrated with dithizone. The palladium extract is wet oxidized and the palladium titrated with dithizone. The method is suitable for gold in amounts greater than 10 ppm and for platinum and palladium in amounts greater than 1 ppm. (auth)

15961 SCS-M-163
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF PHOSPHORUS IN URANOUS FLUORIDE. July 12, 1954. 6p.

The sample is dissolved in aluminum sulfate solution. After reduction of any arsenic present to the trivalent state by means of sulfur dioxide, the phosphorus is determined spectrophotometrically as the reduced phospho-molybdic acid complex. The method is suitable for a phosphorus concentration of 2 to 16 ppm in the presence of up to 50 mg of arsenic. The precision is probably ±1 mg over the range (3 × sigma), 95% confidence level. (J.E.D.)

15962 SCS-M-264
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE ABSORPTIOMETRIC DETERMINATION OF SULPHUR IN URANIUM METAL. Dec. 2, 1953. 7p.

The sample is dissolved in aqua regia. After removal of excess nitric acid by boiling with formic acid, the solution is further boiled to remove excess formic and hydrochloric acids. Hydriodic acid—hypophosphorous acid mixture is then added and the solution distilled. Any sulfate present is thus reduced to hydrogen sulfide which is carried over in a stream of nitrogen, absorbed in zinc acetate solution, and subsequently determined absorptiometrically as Lauth's violet. (auth)

15963 SCS-M-301
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE SPECTROGRAPHIC DETERMINATION OF ALUMINUM AND BERYLLIUM IN MAGNOX ALLOYS. Jan. 25, 1955. 10p.

The sample is dissolved in dilute hydrochloric acid, and to an aliquot of this solution is added a known volume of the internal standard solution containing scandium and vanadium. The solution is then spectrographed by the Porous Cup Electrode technique, using a large quartz spectrograph. The plates are evaluated by the intensity method of plate calibration. The method is applicable for the determination of aluminum in the range 0.7 to 0.9% in the alloy, and beryllium in the range 0.01 to 0.03%. The precision of the method is approximately ±10%. (auth)

15964 SCS-M-396
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF SILICON IN NIOBIUM METAL POWDER AND NIOBIUM COMPOUNDS. Aug. 20, 1955. 5p.

The sample is fused with sodium hydroxide and the melt leached and filtered. The sodium silicate in the filtrate is determined absorptiometrically as the molybdenum blue complex. The method is suitable for silicon contents between 10 and 100 ppm. (auth)

15965 SCS-M-403
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF IRON IN NIOBIUM METAL AND NIOBIUM TRICHLORIDE. Aug. 16, 1955. 4p.

Results indicate that iron can be determined colorimetrically using thioglycollic acid after fusion of the sample and solution of the melt in tartrate medium. The method is suitable for the determination of 10 to 1000 ppm iron in niobium and niobium trichloride. (J.E.D.)

15966 SCS-R-67
Gt. Brit. Ministry of Supply. Chemical Inspectorate, London.
THE SPECTROGRAPHIC DETERMINATION OF CALCIUM IN URANIUM OXIDE. R. Franklin and F. J. Woodman. May 23, 1949. 12p.

The Woolwich method for the determination of calcium in U_3O_8 was investigated with a view to its early introduction to routine work at Springfields. It has not been found entirely applicable as it stands for various reasons; some modifications have therefore been suggested. It has been confirmed that the method is only semi-quantitative necessitating recording spectra at least in quadruplicate. It was found possible to estimate from 5 to 200 ppm Ca by the modified technique. Higher concentrations can be estimated by the normal method of dry dilution with pure U_3O_8. Serious calcium contamination has not been experienced. In the modified method the U_3O_8 is compressed into miniature pellets and arced on copper electrodes at 7 amps. No exposure of the first 45 secs is made as during this period much of the uranium is being removed without undue excitation of the calcium. The spectra are recorded during the next 30 secs on Ilford Thin Film Half Tone plates in a Jarrel-Ash fully automatic grating spectrograph and are read by use of the Hilger non-recording microphotometer. Comparisons are made between the C_a 3933.67 line and four neighboring uranium lines using a two line method of calculation. (auth)

15967 SCS-R-72
Gt. Brit. Springfields Works, Springfields, Lancs, England.
A MINIATURE SHAKING MACHINE FOR POWDERS IN SPECTROGRAPHIC ANALYSIS. R. Franklin, A. Townley, F. J. Woodman, and A. B. Timms. Nov. 3, 1949. 17p.

A miniature shaking machine was designed, constructed, and tested specifically for the rapid and safe mixing of small quantities of silver chloride with black uranium oxide prior to spectrographic analysis by the carrier distillation technique. Precision of results is slightly superior to the manual incorporation method previously used. Other potential applications for preparative work in spectrographic analysis are suggested. (auth)

15968 SCS-R-155
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF URANYL FLUORIDE IN URANOUS FLUORIDE. H. Mason, J. R. Sanderson, and M. Hall. Oct. 12, 1950. 8p.

A method was developed for the estimation of uranyl fluoride in uranous fluoride by selective extraction of the uranyl fluoride with saturated sodium fluoride solution. The use of this reagent reduces the solubility of the uranous fluoride and so minimizes the risk of hydrolysis and subsequent aerial oxidation. After extraction, the suspension is centrifuged and the soluble uranium is estimated colorimetrically using sodium carbonate and hydrogen peroxide. The method is applicable within the range 0.2 to 2% and this can be extended by adjustment of the aliquot of the extract. (auth)

15969 UCRL-8727
California. Univ., Berkeley. Lawrence Radiation Lab.
HIGH-TEMPERATURE STUDIES OF THE C_3 MOLECULE (thesis). John Leland Engelke. Apr. 30, 1959. 84p. Contract W-7405-eng-48. $2.25(OTS).

The C_3 molecule has been produced in thermal equilibrium with graphite. The so-called C_3 continuum has been studied from 3700 to 4850 A, and its unresolved structure has been shown to be part of the C_3 Swings bands. Evidence is presented that the transition is $^1\Pi_u \longleftrightarrow {}^1\Sigma_g^+$ and that the latter is the ground electronic state of C_3. The integrated absorption coefficient of C_3, in the above spectral region, leads to an oscillator strength, f, of 0.2. The temperature coefficients of absorption and emission intensities were measured near 4045 A. The absorption experiment set a lower limit to the heat of formation of C_3, $\Delta H_0^0 = 181$ kcal/mole. The value from the emission experiment is 197 ± 10 kcal/mole. By comparison with other results in the literature, the best value for the heat of formation is taken to be $\Delta H_0^0 = 189 \pm 5$ kcal/mole. (auth)

15970 WADC-TR-55-492(Pt. 4)
Wyandotte Chemicals Corp., Wyandotte, Mich.
RESEARCH AND DEVELOPMENT ON HIGH TEMPERATURE FUEL RESISTANT RUBBER COMPOUNDS. Period covered: February 15, 1958 to February 15, 1959. Raymond G. Spain, Wayne G. Lajiness, and Eva Deck. Feb. 18, 1959. 90p. Project Nos. 7340 and 3048. Contract AF33(616)-5544. (AD-213607).

The development of elastomeric compounds resistant to high energy fuels (HEF) at elevated temperatures is described. Initial screening tests in HEF at moderate temperatures indicated that of the available elastomers only certain fluoroelastomers were suitable for investigations at higher temperatures in HEF. Accordingly, compounding and HEF aging studies were concentrated on these materials. The Micro Tester was completed. This device will permit the determination of the tensile properties of vulcanizates at temperatures up to 600°F, while the test specimens are immersed in test fluids. The Dynamic O-Ring Test Apparatus was also completed. This device will be used to test experimental vulcanizates as O-ring seals for a reciprocating shaft at simulated use conditions. (auth)

15971 WADC-TR-58-276
Wright Air Development Center. Aeronautical Research Lab., Wright-Patterson AFB, Ohio.
PERARYLATED SILANES: A CLASS OF STABLE ORGANIC MOLECULE. Leonard Spialter and Charles W. Harris. Jan. 1959. 20p. Project 7023. (AD-211610).

The perarylated silanes, molecules consisting only of silicon atoms and aromatic groups, show remarkable radiation and heat stability, even when exposed to the oxidative and hydrolytic influence of the atmosphere. These compounds promise interesting applications in improved materials. Experimental findings on the synthesis and selected physical properties of various structural subgroups in the general class of perarylated silanes, including the phenyl-4-biphenylylmonosilanes, the phenyl-2-thienylmonosilanes, and selected silarylenes, are summarized. The potential utility and areas of promise shown for these compounds are described and critically discussed. (auth)

15972 WAPD-CDA(AD)-526
Westinghouse Electric Corp. Bettis Plant, Pittsburgh. DECOMPOSITION OF SOLID FERROUS HYDROXIDE IN HIGH-TEMPERATURE WATER. A. S. Kesten and L. S. Lasher. Feb. 1959. 17p. $3.30(ph), $2.40(mf) OTS.

Solid ferrous hydroxide decomposes in deoxygenated, deionized water at temperatures from 180 to 487°F to give metallic iron and magnetite, primarily the latter. The decomposition appears to be first order with respect to ferrous hydroxide, with a rate constant given by $K = 6.0 \times 10^7 e^{-(21,000/RT)}$ (min^{-1}), where T is in °K. At temperatures 400°F and higher, at least 80% of the ferrous hydroxide decomposes in 2 hours. (auth)

15973 WIS-OOR-22
Wisconsin. Univ., Madison. Naval Research Lab. A CALCULATION OF THE RATE OF THE ORTHO-PARA CONVERSIONS AND ISOTOPE EXCHANGES IN HYDROGEN. Isaiah Shavitt. Mar. 24, 1959. 23p. DA Project No. 599-01-004. (OOR-1858.5; AD-214629).

The rates of the various elementary reactions of the type $H + H_2 \rightarrow H_2 + H$, involving ortho-para conversions or isotope exchanges, have been calculated by the absolute reaction rate theory, using new fundamental quantum-mechanical data for the shape of the H_3 energy surface, but estimating the activation energy to fit experimental results. The transition complex in these calculations is linear and symmetric, in contrast with the dissymmetric complex of the semi-empirical surface. The disparity between the experimental results obtained by different authors and the probable inaccuracies in their data make it very difficult to assess the accuracy of the calculated rate constants. (auth)

15974 AEC-tr-3707
RAMAN SPECTRA OF LITHIUM, SODIUM, POTASSIUM AND SILVER NITRATE MELTS. W. Bues. Translated for Oak Ridge National Lab. from Z. physik. Chem. (Frankfurt) (N.S.) 10, 1-23(1957). 31p. $6.30(ph), $3.00(mf) JCL.

(Figures and tables omitted.)

Raman spectra of alkali and silver nitrate fusions are recorded with an equipment suitable for salt fusions. Discussion of the spectra shows that ions are present in the fusions. The cation influence in the spectra of fusions and crystals cannot be explained in the alkali nitrates only by differences in packing densities. In contrast to the silver ion, the alkali ions do not exert any influence on the NO linkage force in the nitrate ion. As a connecting link between crystal and solution spectra, the fusion spectra permit us to make statements on the state of the nitrate ion in aqueous solution. Thermodynamic data confirm the assumption of ion fusions for the salts observed. (auth)

15975 AEC-tr-3711
THE ACTION OF WATER VAPOR ON LITHIUM. Jean Besson and Werner Muller. Translated by Myra Scott (Savannah River Lab.) from Compt. rend. 247, 1869-72 (1958). 3p. $1.80(ph), $1.80(mf) JCL.

The primary product of the reaction is LiOH with a secondary formation of the monohydrate $LiOH \cdot H_2O$. Starting from 200°C it reacts with excess Li yielding the oxide Li_2O. The hydride LiH also forms in a small quantity at ~450°C. (W.L.H.)

15976 AEC-tr-3716
ABSORPTION SPECTRA OF CRYSTALS OF PLUTONIUM SALTS. A. M. Leontovich. Translated by Lydia Venters (Argonne National Lab.) from Optika i Spektroskopiya 2, 695-703(1957). 11p. $3.30(ph), $2.40(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 7205.

15977 AEC-tr-3734
THERMODYNAMICS OF CHLORINATION OF OXIDES OF RARE EARTH METALS BY GASEOUS CHLORINE. I. S. Morozov and B. G. Korshunov. Translated for General Electric Co. Aircraft Nuclear Propulsion Project from Doklady Akad. Nauk S.S.S.R. 119, 523-5 (1958). 3p. $1.80(ph), $1.80(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 11353.

15978 AERE-Trans-817
ON THE METHOD OF MEASURING REFRACTIVE INDEX. I. J. Kokta. Translated by J. B. Sykes (U.K.A.E.A., Atomic Energy Research Establishment) from František Slavik Mem. Vol., Ceskoslov. akad. ved. 159-166(1957). 10p.

A method was developed for finding the refractive index of powders from the thermal dispersion. A Boetus electric heating table was used as a simplified apparatus. The range 1.55 to 1.66 was investigated using diethylamiline and α-bromophthalene and mixtures of them. (auth)

15979 AERE-Trans-827
VISCOSITY AND THE MEASUREMENT OF VISCOSITY. Franz Lawaczeck. Translated by R. Todd from Z. Ver. deut. Ingr. 63, 677-82(1919). 18p.

The previously known equations for the motion of viscous fluids are given. A new viscometer is described which is applicable to liquids and gaseous and semi-solid materials. (auth)

15980 CEA-tr-A-535
UNE METHODE RAPIDE DE MICRODOSAGE DU FLUOR PAR DISTILLATION ET ABSORPTION. (A Rapid Method for the Microdetermination of Fluorine by Distillation and Absorption.) H. Ballczo, G. Doppler, and A. Lanik. Translated into French from Mikrochim. Acta, 809-22(1957). 24p.

A rapid method for the microdetermination of fluorine is described. The method is based on the distillation of fluorine ions from a solution and absorption in slightly acid aluminum chloride. The amount of fluorine is then determined spectrophotometrically with Chromazurol S. The design of the distillation and absorption apparatus which quantitatively absorbs the fluorine regardless of the speed of passage through the absorber is given in detail. (J.S.R.)

15981 CEA-tr-R367
PRÉPARATION DE L'OXYDE DE DEUTERIUM ET DÉTERMINATION DE SA DENSITÉ. (Preparation of Deuterium Oxide and Determination of Its Density.) A. I. Chatenchtein, L. M. Iakimenko, V. R. Kalinatchenko, and E. A. Iakovleva. Translated from Zhur. Neorg. Khim. 2, 985-94(1957). 24p.

Deuterium oxide was prepared by electrolyzing 20 kg of heavy water ($d_{25}^{25} = 1.10752$, 99.81 at. % D) to which 750 g of potassium tetroxide was added. At the end of 15 days the weight of electrolyte was 1.8 kg and the D content, according to the Raleigh formula, was 99.999997 at. % D. Special methods were used to purify the D_2O, measure its electric conductivity, and place it in pycnometers without exposing it to the atmosphere. Density measurements at 25, 30, 40, and 50°C are recorded. (T.R.H.)

15982 NP-tr-242

CONCERNING THE NATURE OF ISOMORPHISM IN ALKALI BERYLS. V. A. Frank-Kamenetskii and T. A. Sosedko. Translated by P. D. Soskice (U.K.A.E.A. Atomic Energy Research Establishment) from Doklady Akad. Nauk S.S.S.R. 118, 815-17(1958). 5p. $1.80(ph), $1.80(mf) JCL or LC.

The nature of alkalies in beryls was investigated by x-ray examination of beryls of different alkali content. A determination of the lattice parameters in accordance with the data from Debye crystallograms allowed establishment of a regular change in the beryl lattice parameter c, while preserving the constant value of parameter a. Parameter c increases with the increase in the alkali content of the beryls. Indications were found of isomorphic substitutions rather than mechanical admixtures of other minerals in the beryls. (J.R.D.)

15983

NEW RAPID GRAVIMETRIC METHOD FOR THE SEMIMICROGRAPHIC DETERMINATION OF COBALT AND NICKEL AS DILITURATE. J. Dick and Fr. Mihai. Acad. rep. populare, Romîne, Baza cercetări ştiinţ. Timişoara, Studii cercetări ştiinţe chim. 5, 107-11 (1958). (In Rumanian)

A rapid gravimetric method for the semimicrographic determination of Co^{2+} and Ni^{2+} is described. The method depends on the precipitation and direct weighing of the cobalt or nickel diliturate $Co(C_4H_2O_3N_2NO_2)_2 \cdot 8H_2O$ and $Ni(C_4H_2O_3N_2NO_2)_2 \cdot 8H_2O$. This relatively specific method can be done in 15 min and is very accurate. (tr-auth)

15984

COMPLEXOMETRIC DETERMINATION OF NICKEL AND IRON IN THE SAME TEST BY PHOTOCOLORIMETRIC TITRATION. A. Dewald. Acad. rep. populare, Romîne, Baza cercetări ştiinţ. Timişora, Studii cercetări stiinte chim. 5, 125-9(1958). (In Rumanian)

A complexometric titration method for iron and nickel is described. The iron is masked with pyrophosphate, and the nickel is titrated directly with (ethylenediamine)tetraacetic acid (EDTA) in the presence of murexide up to the violet color change. The IF 620 filter is used. The iron is titrated indirectly. An excess of EDTA is added, which destroys the pyrophosphoric complex. The excess EDTA is then titrated with a standard solution of nickel nitrate using an IF 465 filter. (tr-auth)

15985

SPECTROPHOTOMETRIC EXTRACTION METHODS SPECIFIC FOR URANIUM. William J. Maeck, Glenn L. Booman, Maxine C. Elliott, and James E. Rein (Phillips Petroleum Co., Idaho Falls, Idaho). Anal. Chem. 31, 1130-4(1959) July.

Two spectrophotometric extraction methods specific for uranium are described. Uranium as tetrapropylammonium uranyl trinitrate is quantitatively separated from large quantities of diverse ions by extraction into methyl isobutyl ketone (4-methyl-2-pentanone) from an acid-deficient aluminum nitrate salting solution. Milligram levels are determined by a direct absorbance measurement of the trinitrate complex in the separated organic phase at 452 mμ. Microgram amounts are determined by adding dibenzoylmethane (1,3-diphenyl-1,3-propanedione) in an ethyl alcohol–pyridine mixture to the separated organic phase and measuring the absorbance of the chelate at 415 mμ. The coefficient of variation is less than 1% at the 10-mg. and 25-γ levels. The limit of sensitivity is 0.8 γ for the dibenzoylmethane method. (auth)

15986

PRECISE DETERMINATION OF PLUTONIUM BY POTENTIOMETRIC TITRATION. Glenn R. Waterbury and Charles F. Metz (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 31, 1144-8(1959) July.

Macro amounts of plutonium are quantitatively oxidized with fuming perchloric acid, and plutonium(VI) is reduced to plutonium(IV) with a slight excess of standard iron(II) solution, which is then titrated automatically with cerium(IV). Large sample sizes and weight burets are used for precise results. An average value for the plutonium content of a high purity metal sample of 99.98%, with a standard deviation of 0.02%, was obtained for 11 determinations, using 3- to 5-gram aliquots of a solution containing 63.111 mg. of the metal per gram. From the total of the concentrations of the trace impurities, the plutonium content of the sample was calculated to be 99.98%. Of 26 foreign metals investigated, chromium, gold, manganese, vanadium, and platinum seriously interfered. The spectrophotometric titration of plutonium is also discussed. (auth)

15987

SELECTIVE LIQUID-LIQUID EXTRACTION OF IRON WITH 2-THENOYLTRIFLUOROACETONE-XYLENE. APPLICATION TO HOMOGENEOUS REACTOR SOLUTIONS. Fletcher L. Moore (Oak Ridge National Lab., Tenn.) and W. D. Fairman, J. G. Ganchoff, and John G. Surak (Marquette Univ., Milwaukee). Anal. Chem. 31, 1148-51(1959) July.

Extraction of ferric iron from 10M nitric acid solution with 0.5M 2-thenoyltrifluoroacetone–xylene is efficient and more highly selective than ether extraction or anion exchange from hydrochloric acid solution. Scrubbing the organic phase with 0.25M hydrofluoric acid–0.25M nitric acid increases the selectivity. Concentrated hydrochloric acid readily strips the iron from the organic phase. Excellent separation of iron is effected from the alkalies, alkaline earths, rare earths, ruthenium, zirconium, niobium, iodine, tin, antimony, cobalt, manganese, chromium, nickel, thorium, protactinium, and uranium. The technique has been successful in the determination of the specific activity of iron in homogeneous reactor solutions. (auth)

15988

ANALYSIS OF TRACE ACTIVITIES OF COBALT-60 IN HANFORD TREATED WASTE SOLUTIONS. Henry R. Helmholz and Richard A. Schneider (General Electric Co., Richland, Wash.). Anal. Chem. 31, 1151-7(1959) July.

A combination chemical separation and specific counting method for determining trace activities of cobalt-60 in high level radioactive waste solutions in which cobalt-60 is present as a stable cobaltic ammine and/or cobalticyanide complex is described. Cobalt-60 is precipitated from solution as a mixture of insoluble cobaltous and ferrous cobalticyanides after cobaltic ammine complexes have been destroyed by reduction and acid deammoniation. After additional separation from the bulk of interferences, cobalt-60 is specifically determined by a combination of gamma energy discrimination and gamma coincidence counting. (auth)

15989

PHOTOMETRIC TITRATION OF SCANDIUM. James S. Fritz and Donald J. Pietrzyk (Iowa State Coll., Ames). Anal. Chem. 31, 1157-9(1959) July.

A scandium solution containing copper(II) can be titrated photometrically in acid solution with (ethylenedinitrilo)tetraacetic acid (EDTA) in the presence of up to 60 times as much rare earth (on a molar basis). The absorbance of copper(II)-EDTA at 745 mμ is used to follow the course of the titration. Large amounts of aluminum(III), calcium(II), magnesium(II), uranium(VI), and significant amounts of iron(II) and other metal ions do not interfere. Bismuth(III), hafnium(IV), zirconium(IV), fluoride, and sulfate are the most important interferences. The sum of scandium(III) and thorium(IV) can be determined by this method. (auth)

15990

SEPARATION OF THORIUM FROM RARE EARTHS, ZIRCONIUM, AND OTHER ELEMENTS BY CATION EXCHANGE CHROMATOGRAPHY. F. W. E. Strelow (National Chemical Research Lab., Pretoria). Anal. Chem. 31, 1201-3(1959) July.

Thorium has a high affinity for the Dowex 50 cation exchange resin and it is not eluted from a column of the resin even by relatively concentrated hydriochloric acid. Semiquantitative affinities for AG 50 resins in hydrochloric acid were investigated for 23 cations, and "single element" elution curves were prepared for those with high affinities. A method was developed to separate thorium quantitatively, even in small amounts, from zirconium and the rare earths. (auth)

15991

PLATINUM-FLUX TECHNIQUE FOR DETERMINING OXYGEN IN TITANIUM. W. R. Hansen, M. W. Mallett, and M. J. Trzeciak (Battelle Memorial Inst., Columbus, Ohio). Anal. Chem. 31, 1237-41(1959) July.

An investigation was made of the reproducibility of the platinum bath technique for determining oxygen in titanium and its alloys. Although several variations of the platinum-bath technique were tried, the results were not satisfactorily reproducible. However, a modified technique, platinum flux, was developed. The accuracy of the dry-crucible and the platinum-flux techniques as applied to unalloyed titanium, and one alloy, Ti−6Al−4V, was determined by using standard samples. Both techniques appeared capable of recovering at least 92% of the oxygen in unalloyed titanium standards. In most cases the recovery was much better. Average oxygen recovery from Ti−6Al−4V alloy standards was 93% by both the platinum-flux and the dry-crucible techniques. Studies on the reproducibility of analytical values made on three other alloys, Ti−8Mn, Ti−2Fe−2Cr−2Mo, and Ti−5Al−2.5Sn, indicated that satisfactory results could be obtained by both techniques. (auth)

15992

SEMIMICRODETERMINATION OF COMBINED TANTALUM AND NIOBIUM WITH SELENOUS ACID. F. S. Grimaldi and Marian Schnepfe (U. S. Geological Survey, Washington, D. C.). Anal. Chem. 31, 1270-2(1959) July.

Tantalum and niobium are separated and determined gravimetrically by precipitation with selenious acid from highly acidic solutions in the absence of complexing agents. Hydrogen peroxide is used in the preparation of the solution and later catalytically destroyed during digestion of the precipitate. From 0.2 to 30 mg, separately or in mixtures, of niobium or tantalum pentoxide can be separated from mixtures containing 100 mg each of the oxides of scandium, yttrium, cerium, vanadium, molybdenum, iron, aluminum, tin, lead, and bismuth with a single precipitation; and from 30 mg of titanium dioxide, and 50 mg each of the oxides of antimony and thorium, when present separately, with three precipitations. At least 50 mg of uranium(VI) oxide can be separated with a single precipitation when present alone; otherwise, three precipitations may be needed. Zirconium does not interfere when the tantalum and niobium contents of the sample are small, but in general, zirconium as well as tungsten interfere. The method is applied to the determination of the earth acids in tantaloniobate ores. (auth)

15993

THE DETERMINATION OF SILVER IN GALENA AND BLENDE BY RADIOACTIVATION ANALYSIS. D. F. C. Morris and R. A. Killick (Brunel Coll. of Tech., London). Anal. Chim. Acta 20, 587-94(1959) June.

The determination of traces of silver in ores by neutron-activation analysis is described. The method has the advantage of high sensitivity for many elements and can generally be made specific for a given element and may be applied to samples containing < 0.0001% silver. The ultimate sensitivity of the method may be increased by lengthening the time of neutron irradiation and is applicable to various minerals other than galena and blende. (J.E.D.)

15994

CADMIUM SULPHIDE PHOTOCONDUCTIVE LAYERS. R. Lawrence (Australian Atomic Energy Commission, Sutherland, New South Wales). Brit. J. Appl. Phys. 10, 298-300(1959) June.

Notes on experience in the preparation of cadmium sulfide are presented. Layers exhibiting properties similar to those of single crystals can be prepared by evaporation of crystalline CdS onto heated substrates. Photoconductive layers can also be made from the oxide made by sputtering Cd on glass in air. The sputtered layer is baked at 500°C in H_2S, then in air. After cooling, the resulting layer is similar to the high-temperature substrate evaporated layers. Another preparation method involves the use of ordinary laboratory reagent cadmium salts. Salts, such as $CdCl_2$, are heated in a stream of H_2S; upon cooling, a layer is formed which is immediately photosensitive. (J.R.D.)

15995

ANALYSIS OF MIXTURES OF LIGHT AND HEAVY WATER BY MEANS OF A SIMPLE INFRARED PHOTOMETER. A. Berton and M. Ceccaldi. Chim. anal. No. 3, 102-3(1957) Mar. (In French).

A method using a simple infrared photometer is presented for the determination of light and heavy water in mixtures of the two. The method is based on the fact that an incandescent light has a maximum at 1.4 μ, and in this region light water has an intense absorption band and heavy water does not. The photometer used is described, and the curve obtained as a function of the D_2O concentration is presented. (J.S.R.)

15996

THE EFFECTS OF CARBON TETRABROMIDE ON NIOBIUM AND TANTALUM OXIDES. Marcel Chaigneau (Centre National de la Recherche Scientifique, Paris).

Compt. rend. 248, 3173-5(1959) June 1. (In French)

Tantalum pentabromide and niobium oxybromide were prepared by heating the oxides with CBr_4. In the Ta_2O_5 experiments a yellow microcrystalline substance was found but not enough to prove the existence of tantalum oxybromide. (T.R.H.)

15997

THERMOLYSIS OF THE AMIDOSULFONATES OF LANTHANUM, CERIUM, NEODYMIUM, AND SAMARIUM. André Chrétien and Michel Capestan. Compt. rend. 248, 3176-8(1959) June 1. (In French)

The crystallized dihydrates of La, Ce(III), Sm, and Nd amidosulfonates were prepared by dissolving the hydroxide in aqueous amidosulfonic acid for La, Sm, and Nd, and by conversion of barium amidosulfonate by $Ce_2(SO_4)_3$. Thermolysis reveals four compounds: amidosulfonate monohydrate, anhydrous amidosulfonate, lanthanide—ammonium double sulfonate 1/3, and lanthanide—ammonium double sulfonate 1/1. The relative stabilities of these compounds and their thermolyses are discussed. (T.R.H.)

15998

ABSORPTION SPECTRA OF PENTA- AND TETRAVALENT PROTACTINIUM IN AQUEOUS SOLUTION. Robert Guillaumont, Roland Muxart, Georges Bouissières, and Moïse Haïssinsky. Compt. rend. 248, 3298-3300(1959) June 8. (In French)

The absorption spectra of Pa^{5+} in the visible and ultraviolet were measured in $KClO_4$, H_2SO_4, and HCl solutions and Pa^{4+} in H_2SO_4 and HCl. The effect of acidity and the change in the spectrum with the age of the solutions were observed. (tr-auth)

15999

DIRECT AND SIMULTANEOUS DETERMINATION OF STRONTIUM, CALCIUM, SODIUM, POTASSIUM, AND LITHIUM IN THE PRESENCE OF ALUMINUM, IRON, TITANIUM, AND MAGNESIUM BY FLAME SPECTROPHOTOMETRY. Jeannine Debras-Guédon and Igor Voïnovitch. Compt. rend. 248, 3421-3(1959) June 15. (In French)

The emission lines of K, Na, and Li, and principally Sr and Ca are disturbed by other ions present in the solution, especially Al. It was found that addition of oxine completely suppresses this interference and permits simultaneous determination of these five elements in materials as complex as silicates. (tr-auth)

16000

A PYROMETRIC APPLICATION OF THE PHOTOLUMINESCENCE OF ZINC—CADMIUM SULFIDE ACTIVATED BY MANGANESE AND GOLD. Jean-Pierre Leroux and Pierre Thureau. Compt. rend. 248, 3424-6(1959) June 15. (In French)

A change in the color of the photoluminescent emission of mixed Zn and Cd sulfides activated by Au and Mn under the influence of temperature is used for pyrometry. A thermosensitive parameter is explained on the basis of spectral deformation. (tr-auth)

16001

RADIOCHEMICAL DETERMINATION OF CARBOXYL GROUPS IN CELLULOSE OXIDES. Paul Rochas, Paul Bussière, and Louis Gavet. Compt. rend. 248, 3436-8(1959) June 15. (In French)

A simple semi-micro method is offered for determination of the carboxyl groups of cellulose oxides. The method is based on fixing Co^{60} in a cation on the material, followed by direct counting. The results are reproducible and only a small sample is required. (T.R.H.)

16002

METHODS OF OBTAINING HEAVY WATER. J. L. Otero de la Gándara. Energia nuclear (Madrid) 1, No. 2, 45-58(1957) Apr.-June. (In Spanish)

A brief survey is given of the methods used for the production of heavy water. These methods include electrolysis of water, exchange reactions, and distillation. The industrial possibilities of each method is briefly discussed. (J.S.R.)

16003

KINETIC STUDIES ON THE IRON—STEAM REACTION. B. Brigoli, E. Cerrai, A. Scaroni, and M. Silverstri (CISE, Milan). Energia nucleare (Milan) 6, 330-8(1959) May.

Iron containing porous material was prepared to determine its chemical and mechanical behavior during the steam—iron hydrogen-producing reaction. Materials containing about 50 to 90% Fe in Al_2O_3 were prepared, and their mechanical behavior tested. The 90% Fe product was used for kinetic studies on the oxidation and reduction reaction rates. Results are reported and experimental equipment is described. (auth)

16004

ON THE CESIUM REMOVAL BY $MnO(OH)_2$ FROM AQUEOUS SOLUTIONS. T. Gerevini and R. Somigliana (Istituto di Fisica del Politecnico, Milan). Energia nucleare (Milan) 6, 339-44(1959) May.

Cesium adsorption by $MnO(OH)_2$ in a variety of conditions was investigated. The influence of the $MnO(OH)_2$ amount used, the method of precipitation, the pH of the solution, the cesium concentration added, and the interfering ions were tested. The capacity of $MnO(OH)_2$ adsorption and the removal coefficients in different cases were determined. (auth)

16005

RECOVERY OF FISSION PRODUCT CESIUM FROM ACIDIC WASTES. H. H. Van Tuyl and R. L. Moore (General Electric Co., Richland, Wash.). Ind. Eng. Chem. 51, 741-4(1959) June.

Experiments in recovery of Cs from Purex-type processes by precipitation with zinc ferricyanide, zinc cobalticyanide, or nickel ferricyanide are reported. Also, addition of urea to the unconcentrated waste solutions as a nitrite suppressor to prevent oxidation when ferricyanides were used was investigated. It was found that either heating or addition of urea satisfactorily removed nitrite. All three precipitants were found to be usable; however zinc ferricyanide appears to be the best. At least 95% of the cesium can be recovered from concentrated wastes. (J.R.D.)

16006

THIONYL CHLORIDE IN INORGANIC CHEMISTRY. J. H. Freeman and C. E. C. Richards (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 7, 287-8(1958) Oct.

Small quantities of Ba, Ca, and other insoluble sulfates can be converted to the chloride by heating them for 2 to 3 min in a crucible with a small quantity of H_2SO_4 and an excess of $SOCl_2$. When reaction products are evaporated off, the anhydrous chloride is obtained. $SOCl_2$ reacts quantitatively with chromium trioxide and dry dichromates to produce chromyl chloride. There is no reaction with chromates, hence the reagent provides a sensative test to distinguish between chromates and dichromates. An experiment at room temperature in which $SOCl_2$ was reacted with H_2O and D_2O_3 in open test tubes showed that the reaction with distilled water proceeded four times more rapidly than that with heavy water. This difference is probably exaggerated by physical factors controlling the size of the interface between the two reacting liquids. An attempt was made to study the true reaction rate by using a solvent in which the water and $SOCl_2$ were soluble, but since $SOCl_2$ reacts with most lyphillic solvents, the results were inconsistent. It is noted that polyvinyl chloride and polythene are soluble in $SOCl_2$. (T.B.A.)

16007

TRITIUM LABELING OF ORGANIC COMPOUNDS BY MEANS OF ELECTRIC DISCHARGE. Leon M. Dorfman and Kenneth E. Wilzbach (Argonne National Lab., Lemont, Ill.). J. Phys. Chem. 63, 799-801(1959) June.

Tritium labeling of solid organic compounds by means of electric discharge in tritium in the 10 mm pressure region is shown to be a feasible technique. Details of experiments with p-dichlorobenzene, naphthalene, and palmitic acid are presented. Some advantages of the discharge method are pointed out, and results are compared with those obtained by the gas exposure technique for labeling. (auth)

16008

ABSOLUTE RATE CONSTANTS FOR H ATOM REACTIONS IN AQUEOUS SOLUTIONS. Peter Riesz and Edwin J. Hart (Argonne National Lab., Lemont, Ill.). J. Phys. Chem. 63, 858-61(1959) June.

In order to determine the absolute rate constant of the reaction $H + Fe^{III} = Fe^{II} + H^+$, the relative rate constant ratio $k_{(H + Fe^{III}}/k_{(H + D_2)}$ was measured, and $k_{(H + Fe^{III})}$ was also calculated by assuming that $k_{(H + D_2)}$, known from gas phase studies, remains unchanged in solution. The initial HD yields from the γ irradiation of water containing dissolved deuterium gas, ferric sulfate, and ferrous sulfate have been measured at various Fe^{III}/D_2 ratios. From these studies the rate constant ratio $k_{(H + Fe^{III})}/k_{(H + D_2)} = 120 \pm 30$ in 0.01 N H_2SO_4 was calculated. Since the rate constant of the gas reaction, $H + D_2 = HD + D$, equals 0.4×10^5 l. mole^{-1} sec.$^{-1}$, it follows that the rate constant of the reaction $H + Fe^{III} = Fe^{II} + H^+$ in 0.01 N H_2SO_4 is $(0.48 \pm 0.1) \times 10^7$ l. mole^{-1} sec.$^{-1}$ at 25°. Using this result, absolute rate constants for H atom reactions were calculated. (auth)

16009

X-RAY STUDY OF THE BORIDES YbB_6, UB_4, HoB_4 AND GdB_4. A. A. Stepanova and N. N. Zhuravlev. Kristallografiya 3, No. 1, 94-5(1958).

An x-ray study was made of powders of YbB_6, UB_4, HoB_4, and GdB_4. The thermal expansion of cubic YbB_6 was measured, and the coefficient was found to be 5.85×10^{-6} deg^{-1}. The dependence of the crystallographic index a on the temperature is shown. The data obtained for the other tetragonal compounds are tabulated:

Compound	a in kX	c in kX
UB_4	6.983 ± 0.005	3.930 ± 0.003
HoB_4	7.050 ± 0.005	3.992 ± 0.003
GdB_4	7.079 ± 0.005	4.030 ± 0.004

(J.S.R.)

16010

PHOTON ACTIVATION MEASURES OXYGEN, CARBON IN BERYLLIUM. D. B. Beard, R. G. Johnson, and W. G. Bradshaw (Lockheed Aircraft Co., Palo Alto, Calif.). Nucleonics 17, No. 7, 90-1; 93-4; 96(1959) July.

A photon-activation method capable of recognizing 1 ppm of oxygen or carbon in beryllium when other impurities are negligible is described. Experimental results are consistent with calculations from theoretical considerations and chemical analysis. (A.C.)

16011

THE POTENTIALITIES AND LIMITATIONS OF THE PARAMAGNETIC RESONANCE METHOD IN RADIATION RESEARCH. Ralph Livingston (Oak Ridge National Lab., Tenn.). Radiation Research Suppl. No. 1, 463-78 (1959).

Applications of the paramagnetic resonance method to radiation research are discussed. Results are reported from applications of the method in studies on radiation effects on methanol and ethanol. The theory of the paramagnetic resonance phenomena and the thermal relaxation process is discussed. Paramagnetic resonance spectrometers are described. The consequences of the electron possessing orbital angular momentum, the hyperfine interaction, and the potentiality of making quantitative assays are considered. The method is said to be applicable as a means of detecting any type of unpaired electron system. Those of greatest interest in radiation research are free radicals and atoms. 14 references. (C.H.)

16012

NEGATIVE IONS OF OXYGEN. G. S. Hurst and T. E. Bortner (Oak Ridge National Lab., Tenn.). Radiation Research Suppl. No. 1, 547-57(1959).

Electron beam methods, in which the electrons are nearly monoenergetic, and electron swarm methods, in which the electrons have a considerable spread of energies, were applied in studies on the formation of negative ions of oxygen. Experimental results are reported and discussed. 40 references. (C.H.)

16013

INTRA- AND INTERMOLECULAR RADIATIONLESS QUANTUM TRANSITIONS IN COMPLEX MOLECULES. H. Sponer (Duke Univ., Durham, N. C.). Radiation Research Suppl. No. 1, 558-76(1959).

Reaction mechanisms in intramolecular energy transfer and intermolecular energy transfer are discussed. Applications of the findings in the fields of photobiology, photochemistry, and radiobiology are summarized. In the discussion on intramolecular radiationless transitions, predissociation and internal conversion are stressed. Processes describing fluorescence by sensitization are discussed in detail. 52 references. (C.H.)

16014

CRYSTALS WITH LATTICE DISORDERS. STRUCTURAL INFORMATION ON PROMETHIUM OXIDE. Sergio Pizzini and Renato Barbieri (CNR, Padua). Ricerca sci. 29, 1048-52(1959) May. (In Italian)

The distribution of the sesquioxide of promethium-147 between an almost fluoritic phase composed of cerium dioxide saturated in lanthanum sesquioxide and an "A" type phase consisting of lanthanum sesquioxide saturated with cerium dioxide was studied. The fact that promethium is localized in the fluoritic phase suggests that promethium sesquioxide has a phase of the "C" type structure. (auth)

16015

THE P, T, x RELATIONSHIPS OF H_2 + HD AND $H_2 + D_2$ MIXTURES BETWEEN 18° AND 28°K. R. B. Newman and L. C. Jackson (Univ. of Bristol, Eng.). Trans. Faraday Soc. 54, 1481-91(1958) Oct.

The preparation and distillation of HD and D_2 are described, and a comparison is made between their vapor pressure curves and that for normal hydrogen from 18 to 28.5°K. The dew- and boiling-point method was used to investigate the P, T, x relationships for $H_2 + D_2$ and H_2 + HD mixtures in the same temperature range. Deviations from Raoult's law are greater for dew points than for boiling points, but do not exceed 4%. (auth)

16016

PREPARATION OF ANHYDROUS CHLORIDES OF CERIUM AND THORIUM. R. Didchenko (National Carbon Research Labs., Cleveland). Trans. Met. Soc. AIME 215, 401-2(1959) June.

A method of preparation was developed, based on the formation of a double salt or complex between cerium trichloride and pyridinium chloride and subsequent thermal decomposition of this salt in dry hydrogen chloride under reduced pressure. The method was found to be applicable to dehydration of $ThCl_4 \cdot 4H_2O$. (J.E.D.)

16017

THE PREPARATION OF HIGH-PURITY URANIUM METAL BY THE BOMB REDUCTION OF URANIUM TETRAFLUORIDE WITH CALCIUM. R. W. Kewish and O. E. Fry (Kaiser Aluminum and Chemical Corp., Baton Rouge, La.); R. J. Bard, J. P. Bertino, S. W. Hayter, and A. W. Savage, Jr. (Los Alamos Scientific Lab., N. Mex.); F. J. Hill (Trionics Corp., Madison, Wis.); and B. L. Kelchner (Dow Chemical Corp., Rocky Flats Plant, Colo.). Trans. Met. Soc. AIME 215, 425-9(1959) June.

The preparation of massive uranium metal containing very low concentrations of a number of light elements by bomb reduction of UF_4 with calcium is described. Details of procedures are given for preparing high-purity ingredients for the bomb reduction. The as-reduced uranium metal contained, on the average, less than the following amounts of light element impurities, in ppm: Li, 0.1; Be, 0.1; B, 0.1; C, 25; O, 70; Na, 1; Mg, 3; Al, 2; and Si, 7. Other impurities for which the metal was examined averaged, in ppm: Ca, <10; V, <10; Cr, 2; Mn, 6; Fe, 50; Co, <5; Ni, 8; and Cu, 1. (auth)

16018

THE SEPARATION OF RARE EARTHS BY ION EXCHANGE. J. E. Powell and F. H. Spedding (Iowa State Coll., Ames). Trans. Met. Soc. AIME 215, 457-63(1959) June.

A complete review of the use of chelating agents in the separation of rare earths by ion exchange is given as well as a concise description of the recent pilot-plant operations of the Ames Laboratory. The two chelating agents which show the greatest promise are ethylenediamine-N,N,N',N'-tetraacetic acid and N'-(2-hydroxyethyl)ethylenediamine-N,N,N'-triacetic acid. (auth)

16019

IODIDE COLUMBIUM. R. F. Rolsten (E. I. du Pont de Nemours and Co., Inc., Gibbstown, N. J.). Trans. Met. Soc. AIME 215, 478-83(1959) June.

Iodide niobium was prepared by the thermal decomposition of niobium iodide(s) on an indirectly heated quartz surface. The metal was deposited on and easily removed from the quartz surface without contamination. Various commercial grades of niobium were used and, in all cases, the niobium deposited was considerably purer than the commercial material. Typical analyses of three pounds of iodide niobium are: 0.033 to 0.059% O; 0.001 to 0.005% N; and 0.001 to 0.005% C. Some of the results of melting niobium at reduced pressure, results of rolling arc-melt buttons at −196°C, change of hardness, and grain growth at various annealing temperatures are discussed in a cursory manner. (auth)

16020

ELASTIC PROPERTIES OF ARTIFICIAL GRAPHITE. Richard Arnold. Z. angew. Phys. 11, 179-83(1959) May. (In German)

An investigation was made to determine the plastic elongation and the modulus of elasticity of artificial graphite and to show the effects of various measuring methods on the determination of the properties. It is shown that the plastic elongation is much smaller than previously reported and is at best only 0.02%. In elongation measurements with strain gages it was found that the modulus of elasticity is constant and equal in the tensile-compression range. The Poisson number was determined to be 0.22. In the determination of the modulus of elasticity by bending, the same material was used as in the tensile-compression tests. The effect of the ratio of height to length was investigated, and it was shown that with the addition of filon the shearing stress was allowed for in a short thick beam. Therefore, agreement was obtained between the modulus of elasticity found by the tensile-compression tests and the bend tests. (tr-auth)

16021

CHEMISTRY OF NUCLEAR POWER. J. K. Dawson and G. Long. London, George Newnes, Ltd., 1959. 214p.

The subjects discussed in this volume are: the role of the chemist in the atomic energy industry, raw materials, fission and the fission products, new heavy elements, separation processes, handling of radioactive materials, water-cooled nuclear reactors, gas-cooled reactor systems, disposal of radioactive wastes, and future applications. (W.L.H.)

16022

BORON FLUORIDE AND ITS COMPOUNDS AS CATALYSTS IN ORGANIC CHEMISTRY. International Series of Monographs on Organic Chemistry. Volume 2. (Translation from the Russian). A. V. Topchiev, S. V. Zavgorodnii, and Ya. M. Paushkin. New York, Pergamon Press, 1959. 326p.

A monograph is presented in which the use of BF_3 as a catalyst in organic chemistry is examined. In addition, a number of BF_3 derivatives and coordination compounds are discussed. Catalysts based on BF_3 are more active in many reactions than mineral acids and halogen compounds of metals, and at the same time do not give rise to undesirable side reactions such as the destructive changes observed when $AlCl_3$ is used, or in sulfonation and fluorination. (J.R.D.)

16023

PRODUCTION OF HEAVY WATER. (to U. K. Atomic Energy Authority (U.S.A.)). British Patent 795,920. Nuclear Eng. 4, 48(1959) Jan.

Steam is reduced in a fluidized mixture with a finely divided reducing material (iron or iron monoxide) at high pressures (up to 1,100 atm) and temperatures (650 to 900°C). The mixture of deuterium and hydrogen is then separated from the reducing material and brought into reaction with liquid water under full pressure of hydrogen production, so that part of the hydrogen is replaced by deuterium. The hydrogen and any residual deuterium are then separated from the water of increased D_2O content, which is withdrawn and recycled. D_2O occurs in natural water in a concentration of 1 to 6,000 and by the new process may be concentrated to between one and 10%. For further concentration other methods are preferable.

16024
PRODUCTION OF URANIUM HALIDES. U. K. Atomic Energy Authority (U.S.A.). British Patent 803,258. Nuclear Eng. 4, 284(1959) June.

Uranium tetrafluoride is prepared from the oxide U_3O_8 by maintaining the oxide in particle form in fluidized suspension at elevated temperature in hydrogen to convert it to uranium dioxide. Uranium tetrahalide is then produced by the interaction of a gaseous hydrogen halide and the uranium dioxide at elevated temperature maintained in fluidized suspension in the hydrogen halide.

16025
EXTRACTION OF METALS FROM AQUEOUS SOLUTION. N. F. Kember and U. K. Atomic Energy Authority. British Patent 803,264. Nuclear Eng. 4, 284(1959) June.

Thorium, uranium, zirconium, and hafnium are extracted by an adsorption method based on the observation that these metals are strongly adsorbed from aqueous mineral acid solution by phosphorylated cellulose. The aqueous solution containing the metals should have a concentration at least 10-N with respect to mineral acid.

16026
PROCESS FOR THE PRODUCTION OF WATER OR HYDROGEN HAVING AN INCREASED DEUTERIUM CONTENT. E. W. A. Becker (Germany). British Patent 803,274. Nuclear Eng. 4, 284(1959) June.

Hydrogen and water are passed in counter-current, at elevated pressure (100 atm) and in the presence of a catalyst through two columns, a lower and an upper column, maintained at different temperatures. The water passes first through the cold column (20 to 50°C) and then through the hot column (about 200°C) whereas the hydrogen passes first through the hot column and then through the cold column. The cold column serves as a concentration column. The catalyst is preferably a platinum or palladium sol in the water circulating through the columns. The deuterium-enriched product may be continuously withdrawn in various ways.

Radiation and Radiochemistry

16027 A/CONF.15/P/79
RECENT DEVELOPMENTS IN ANALYSIS WITH SPECIAL REFERENCE TO REACTOR RESEARCH. H. M. Davis, F. W. J. Garton, and H. I. Shalgosky (United Kingdom Atomic Energy Authority, Woolwich Outstation, Eng.), and E. N. Jenkins and G. W. C. Milner (Atomic Energy Research Establishment, Harwell, Berks, Eng.). 15p.

New procedures for chemical analysis are briefly described which were developed for use during reactor research. These include the following: the use of x-ray spectroscopy in determinations of the lead content of Santowax used as a moderator-coolant, direct determinations of the hafnium content of zirconium at the 100 ppm level, the niobium content of fuel elements at the 100 ppm level, tantalum in uranium alloys containing 0.5 to 1.5% tantalum, and tantalum in magnesium oxide; cathode ray polarography for the determination of the cadmium and aluminum contents of heavy water at the 0.02 ppm level without any prior concentration; determination of Li^6/Li^7 ratios using a 3 meter emission spectrograph having a resolving power of 250,000 to 750,000 and a dispersion of approximately 0.3 A per min; the determination of micro-microgram amounts of lithium using a high-sensitivity flame photometer; procedures employing differential spectrophotometry for the analysis of alloys of plutonium with uranium, iron, aluminum, thorium, and molybdenum; determination of the degree of total atom per cent burn up endured by enriched and natural uranium alloys in irradiated fuel elements by non-destructive γ-spectrometry at levels of 0.05 to 0.5% burn up; analytical procedures for the determination of micro amounts of uranium, copper, nickel, chromium, and iron in samples of enriched uranyl sulfate solutions; and the analysis of many bismuth base alloys in which the constituents are determined chemically after separation of bismuth by ion exchange or solvent extraction procedures. (C.H.)

16028 AERE-R/R-2459
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
OSCILLATOR MEASUREMENTS OF SOME MAJOR FISSION PRODUCT POISONS. R. B. Tattersall, W. A. Cooper, D. Jowitt, and S. K. Pattenden. Feb. 1958. 13p.

Measurements were made on the neutron absorption cross sections of the fission product poisons Sm^{149}, Gd^{155}, Gd^{157}, Gd^{113}, Nd^{143}, Sm^{152}, and Cs^{133} using the pile oscillators in Dimple (thermal spectrum) and Gleep (pile spectrum). The measurements on Sm^{149}, Gd, and Cd^{113} showed that the effective temperature of the Maxwellian component of the neutron spectrum in Gleep was 70 ± 10°C which is 45°C above the physical temperature of the graphite moderator. A rough measurement of the cross section of Sm^{147} has also been made. (auth)

16029 CF-58-10-5
Oak Ridge National Lab., Tenn.
PRELIMINARY ESTIMATE OF THE COST OF PRODUCING ENRICHED OXYGEN-18 WATER BY DISTILLATION. J. S. Drury and B. B. Klima. Oct. 10, 1958. 53p. Contract [W-7405-eng-26]. $9.30(ph), $3.60(mf) OTS.

An order of magnitude estimate was made to determine the cost of producing oxygen-18 enriched water by the equilibrium distillation of water. Three isotopic purities and two production rates were considered. Costs varied from $26 per gram for 3% oxygen-18 enriched water produced at a rate of 100 grams per day to $225 per gram for 99% oxygen-18 water produced at a rate of one gram per day. (auth)

16030 IDO-14445
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
LABORATORY DEVELOPMENT OF A PROCESS FOR SEPARATING BARIUM-140 FROM MTR FUEL. E. L. Anderson, R. S. MacCormack, and C. M. Slansky. Mar. 27, 1959. 108p. Contract AT(10-1)-205. $2.50 (OTS).

The results of all laboratory research and development on the process for separation of barium-140 from MTR fuel elements are presented. The steps include caustic dissolution, separation of barium and strontium with fuming nitric acid and removal of strontium by the chromate-acetate method. The results of laboratory and pilot plant corrosion investigations and high radiation level flowsheet tests in the Multicurie Cell are also included. (auth)

16031 NP-7550

Akademiia Nauk S.S.S.R. Institut Fizicheskoi Khimii im. L. J. Karpova and Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

ON THE REDUCTION OF FERRIC IONS IN GAMMA-IRRADIATED AQUEOUS SOLUTIONS CONTAINING CERTAIN ORGANIC SUBSTANCES. Report No. 65. A. I. Tshernova and S. Minc. Jan. 1959. 9p.

A study was made to find conditions for sensitization of reduction of ferric ions in aqueous solutions by the addition of organic compounds which could bind the OH radicals. The method has made it possible to increase the yields of radiochemical reaction of dissolved compounds up to 10 to 12 equivalents per 100 ev. (J.E.D.)

16032 NP-7641

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

THE PREPARATION OF CARRIER-FREE PHOSPHORUS-32 FROM PILE IRRADIATED SULPHUR. Report No. 69/V. A. Poczynajło and I. G. Campbell. Mar. 1958. 12p.

The suitability of extracting P^{32} from irradiated sulfur by dissolving the target in organic solvents and extracting the solution with acids is examined. The bulk of the chemical separations is carried out prior to irradiation. The procedure and results are discussed, and properties such as half life and beta particle energy are given. Also, the results of extraction efficiency tests are reported, as well as analytical results on carrier free $H_3^{32}PO_4$. (J.R.D.)

16033 NP-7642

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

REACTIONS OF NEUTRON—ACTIVATED ARSENIC ATOMS IN ORGANIC MEDIA. PART 1. FORMATION OF PHENYL ARSENIC COMPOUNDS DURING NEUTRON IRRADIATION OF ARSENIC TRICHLORIDE IN BENZENE. K. E. Siekierska, A. Sokołowaka, and I. G. Campbell. Mar. 1959. 21p.

During the pile irradiation of arsenic trichloride in benzene, diphenyl and monophenyl arsenic compounds were formed. Intervention of billiard ball type collisions are excluded in this case, and the result must be attributed to formation of phenyl radicals due to collisions of arsenic atoms of high kinetic energy with benzene molecules, or activation of benzene molecules during neutralization of the positive charge acquired by the arsenic atom as a result of the (n,γ) reaction. The result is compared with results of irradiation of triphenylarsine, in which both billiard ball collisions and radical type mechanisms could play a part. A paper chromatographic technique was developed to supplement column chromatography for separating the products of irradiation. (auth)

16034 AEC-tr-3721

PREPARATION OF $H_2SO_4^{35}$ AND OF CERTAIN OTHER SIMPLE MINERAL COMPOUNDS LABELED WITH S^{35}. E. Gueronniere and R. Henry. Translated by A. L. Monks (Oak Ridge National Lab.) from Report CEA-858. 12p. \$3.30(ph), \$2.40(mf) JCL.

The preparation of S^{35} in reactors by the reaction $Cl^{35}(n,p)S^{35}$ ($\sigma_{th} = 0.169$) is described. The preparation of $H_2S^{35}O_4$ by the (n,p) reaction without a carrier is reported. The preparation of S^{35} labeled sulfur is also included. (W.L.H.)

16035 JPRS(NY)-734

APPLICATION OF RADIOISOTOPES IN USSR INDUSTRY. (Translation). 67p. (PB-141478-T). \$1.75 (OTS).

English abstracts from Russian language publications on gamma relays for coal industry automation, radioisotope measurement of rolled steel thickness, and applications of radioisotopes in metallurgy are presented. (J.R.D.)

16036

RAPID ANALYSIS OF GAMMA-EMITTERS USING GAMMA-RAY SCINTILLATION SPECTROMETER. II. DETERMINATION OF ^{137}Cs IN FISSION PRODUCTS. Fumio Aoki, Seishi Yajima, and Toshio Kurosawa (Government Chemical Industrial Research Inst., Tokyo). Bull. Chem. Soc. Japan 32, 42-5(1959) Jan.

A method for rapid determination of Cs^{137} in fission products was studied. Known quantities of Cs^{137} were added to fission product solution samples. U was extracted with T.B.P. and the solution treated through an anion exchange bed. A gamma-ray scintillation spectrometer was used to compare the real peak height of the 0.66 Mev gamma and the added Cs^{137} quantity. (J.R.D.)

16037

THORIUM IN STONE METEORITES BY NEUTRON ACTIVATION ANALYSIS. G. L. Bate, J. R. Huizenga, and H. A. Potratz (Argonne National Lab., Lemont, Ill.). Geochim. et Cosmochim. Acta 16, 88-100(1959) May.

Radiochemical procedures for assay of Pa^{233} following neutron activation of Th^{232} in stone meteorites are described in detail. Eight analyses of five chondrites yielded an average concentration of $(3.96 \pm 0.20) \times 10^{-8}$ g Th/g which, with proper assumptions, leads to a cosmic atomic abundance of 0.026 for thorium (per 10^6 Si atoms). The thorium concentrations in two achondrites were found to differ by nearly two orders of magnitude. On comparison with uranium concentrations in stones determined by neutron activation analysis, the Th/U ratio in chondrites and achondrites agree to nearly 5 per cent, yielding an average weight ratio of about 3 to 6. (auth)

16038

RADON IN THE NEW ZEALAND GEOTHERMAL REGIONS. R. E. Belin (Snowy Mountains Hydroelectric Authority, Cooma, N.S.W., Australia). Geochim. et Cosmochim. Acta 16, 181-91(1959) May.

Measurements were made on radon and thoron associated with gas and condensate samples from fumaroles and pools, situated along the Rotorua—Taupo graben. Methods of collection and measurement are briefly described. The values of radon to gas (R_g) range from 0.8×10^{-9} to 320×10^{-9} curies/liter (c/l) for pools and 0.32×10^{-9} to 340×10^{-9} c/l for fumaroles. Radon to condensate values (R_c) for fumaroles fall in the range of 7×10^{-9} to 340×10^{-9} c/l of condensate. Variations in discharges of radon and thoron have been related to geology, i.e., there is a greater radioactive discharge from acid igneous regions than from intermediate igneous regions. The ratio of the average of the R_c-values for fumaroles in the acid igneous region to the average of the R_c-values for fumaroles in the intermediate igneous regions is equal, within experimental error, to the ratio of the γ-counting rates of the surface rocks of the two regions. It is therefore suggested that it is steam or water which is responsible for bringing the radioactive gases to the earth's surface. (auth)

16039

EXCHANGE REACTIONS BETWEEN HYDROGEN GAS AND HYDROXYL GROUPS. A CONVENIENT PREPARATION OF TRITIUM-LABELED WATER. C. Gardner Swain and A. Jerry Kresge (Massachusetts Inst. of Tech., Cambridge). J. Am. Chem. Soc. 80, 5281-3(1958) Oct. 5.

The exchange reactions between deuterium gas and methanol or water catalyzed by platinum have been found to proceed at a convenient rate at room temperature and to be limited to exchange of hydroxylic hydrogen. Use of this reaction to label water with tritium provides a superior method for preparing tritiated water. An extension to the preparation of tritiated alcohols is suggested. (auth)

16040

EXTRACTION OF ^{35}SULPHUR FROM PILE-IRRADIATED POTASSIUM CHLORIDE. R. G. Deshpande (Atomic Energy Establishment, Bombay). J. Chromatog. 2, 117-18(1959) Jan.

A method for the separation of S^{35} from pile-irradiated KCl in which the separation of carrier-free S^{35} is simplified through the use of an anion-exchange column is described. The separation of S^{35} from P^{32} and K^+ is effected in a single step. Millicurie amounts of S^{35} were isolated by this method, and it is now being adopted for routine production of the isotope. (J.R.D.)

16041

CHEMICAL EFFECTS OF LOW ENERGY ELECTRONS. Russell R. Williams, Jr. (Haverford Coll., Penna.). J. Phys. Chem. 63, 776-80(1959) June.

A new technique was developed for the study of chemical decomposition of gases by low-energy electrons. Ultraviolet light falling on a silver surface generates photoelectrons which are accelerated in the gas by application of an electric field. The electron yields of products formed by irradiation of methane and ethane were examined as a function of applied potential, and the behavior of the systems suggests that an important primary process is non-ionizing excitation by electron impact. (auth)

16042

DETERMINATION OF FREE RADICAL YIELDS IN THE RADIOLYSIS OF MIXTURES BY THE POLYMERIZATION METHOD. Adolphe Chapiro (Faculté des Sciences, Paris). J. Phys. Chem. 63, 801-7(1959) June.

Radiation-initiated solution polymerization of vinyl monomers can be used as a method for investigating the radiolysis of binary mixtures. In such systems the monomer is one of the components of the mixture and at the same time acts as a free radical scavenger. The rate of free radical production in the system can be derived from polymerization rates provided the rate constants for chain propagation and termination are known. A number of systems have been examined. In the most simple case the rate of free radical production is a linear function of chemical composition of the mixture. This situation applies to styrene solutions in aromatic hydrocarbons and to methyl methacrylate and vinyl acetate solutions in methyl and ethyl acetate. Other systems however exhibit "protection" and sensitization effects. These results are discussed on the basis of current theories for the kinetics of energy transfer processes. Free radical yields are derived from all available data, and the results are compared with yields obtained by other methods. (auth)

16043

THE DEPENDENCE OF RADICAL AND MOLECULAR YIELDS ON LINEAR ENERGY TRANSFER IN THE RADIATION DECOMPOSITION OF 0.8 N SULFURIC ACID SOLUTIONS. Nathaniel F. Barr and Robert H. Schuler (Brookhaven National Lab., Upton, N. Y.). J. Phys. Chem. 63, 808-12(1959) June.

Absolute radiation yields for oxidation of ferrous ion in deaerated solution and for the reduction of ceric ion in aerated and deaerated 0.8 N sulfuric acid solutions were determined for a number of different radiations having energy loss parameters from 0.02 to 25 e.v./A. These data have been combined with the results of previous measurements on the oxidation of ferrous ion in aerated solution to obtain values for the individual radical and molecular yields characteristic of the various radiations. A quantitative description of the dependence of these radical and molecular yields on linear energy transfer is given. (auth)

16044

RADIATION CHEMISTRY OF ORGANIC COMPOUNDS. IV. CYCLOHEXANE. Harold A. Dewhurst (General Electric Research Lab., Schenectady, N. Y.). J. Phys. Chem. 63, 813-16(1959) June.

The major products formed in the 800 kvp electron radiolysis of cyclohexane are hydrogen, cyclohexene, and dicyclohexyl. Minor amounts of products result from fragmentation and isomerization of the ring system. The initial yields are, $G(C_6H_{10}) = 2.5$ and G(dicyclohexyl) = 2.0 and were unchanged by irradiation either in 10 atmospheres of hydrogen or at liquid nitrogen temperature. In the presence of solutes, oxygen, iodine, and benzene, the cyclohexene yield decreased to a limiting value of G = 0.7. The results are discussed in terms of a mechanism which involves the decomposition of excited cyclohexane molecules. The results show that of the excited molecules that decompose approximately 15% give products directly by an unspecified molecular process. (auth)

16045

REDUCTION OF DICHROMATE ION BY THALLOUS ION INDUCED BY γ-RADIATION. Thomas J. Sworski (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 63, 823-5(1959) June.

Reduction of dichromate ion in air-saturated 0.4 M sulfuric acid is induced by γ radiation with $G(Cr^{+++}) = {}^1/_3[2G_{H_2O_2} + G_H - G_{OH}]$. $G(Cr^{+++})$ is increased to ${}^1/_3[2G_{H_2O_2} + G_H + G_{OH}]$ by addition of thallous ion. Thallous ion is oxidized by OH radical yielding thallium(II) ion which reduces dichromate ion with concomitant production of thallic ion. Neither dichromate ion nor the intermediate chromium(V) and chromium(IV) ions oxidize thallous ion to thallium(II) ion. Chromic ion at concentrations as high as 10^{-2} M has no measurable effect on $G(Cr^{+++})$ either in the presence or absence of thallous ion at concentrations as low as 10^{-4} M. The specific reaction rate $k_{Cr^{+++},OH}$ is so low that (a) chromic ion at concentrations as high as 10^{-2} M does not measurably decrease $G_{H_2O_2}$ and (b) $k_{Tl^+,OH}/k_{Cr^{+++},OH}$ cannot be evaluated even with values as high as 100 for $(Cr^{+++})/Tl^+)$. (auth)

16046

RADIOLYSIS OF WATER BY PARTICLES OF HIGH LINEAR ENERGY TRANSFER. THE PRIMARY CHEMICAL YIELDS IN AQUEOUS ACID SOLUTIONS OF FER-

ROUS SULFATE, AND IN MIXTURES OF THALLOUS AND CERIC IONS. Marc Lefort and Xavier Tarrago (Faculté des Sciences, Paris). *J. Phys. Chem.* 63, 833-6(1959) June.

In order to measure the primary chemical yields of water radiolysis, mixtures of thallous and ceric ions in aqueous 0.8 *N* H_2SO_4 solutions were irradiated by plutonium α particles. Absolute dosimetry measurements were carried out. A G-value of 5.5 ± 0.1 was found for ferrous sulfate oxidation. From this value and from results obtained on the ceric system, the following values were determined: $G_{OH} = 0.50$, $G_{HO_2} = 0.11$, $G_{H_2O_2} = 1.45$, $G_{\bar{H}} = 0.60$ $G_{H_2} = 1.57$, and $G_{H_2O} = 3.62$. However, these yields depend on the concentration of thallous ions which inhibit the intratrack reaction $H_2O_2 + OH \rightarrow H_2O + HO_2$. An explanation also is given for the low yield (3.6) obtained for the oxidation of ferrous sulfate in deaerated solutions. (auth)

16047

IRRADIATION OF POLYETHYLENE. IV. OXIDATION EFFECTS. Hiroshi Matsuo and Malcolm Dole (Northwestern Univ., Evanston, Ill.). *J. Phys. Chem.* 63, 837-43(1959) June.

The radiolytic oxidation of a linear polyethylene has been studied by measuring changes in total pressure, by observing increases in optical density in the infrared due to carbonyl absorbance, and by analyzing gaseous products of oxidation when polyethylene film of different thicknesses was exposed to γ radiation in the initial presence of a few centimeters pressure of oxygen. A steady rate of oxidation was soon established, making valid the use of a solution of the differential equation combining both diffusion and reaction for the steady state. About one fourth of the combined oxygen appeared as carbonyl and one eighth as water. Another eighth of the oxygen formed a mixture of carbon monoxide and dioxide. The rest of the oxygen must have formed mostly peroxides and alcohols. Product yields were linear with amount of oxygen consumed whether during the irradiation or in the dark period subsequent to the irradiation. Hydrogen gas evolution and growth and decay of unsaturation apparently were unaffected by the presence of oxygen, but the dose required to reach the gel point was increased. Chemical mechanisms are discussed. (auth)

16048

SOME RADICAL AND MOLECULAR YIELDS IN THE γ-IRRADIATION OF SOME ORGANIC LIQUIDS. G. E. Adams, J. H. Baxendale, and R. D. Sedgwick (The University, Manchester, Eng.). *J. Phys. Chem.* 63, 854-8 (1959) June.

The hydrogen and methane yields from the γ irradiation of ethanol, isopropyl alcohol, *t*-butyl alcohol, cyclohexanol, cyclohexane, diethyl ether, acetic acid, and ethyl acetate have been measured. These yields are decreased by the presence of benzoquinone, which is interpreted in terms of its scavenging effect for H atoms and CH_3 radicals. Kinetic analysis of the results gives values of primary yields of H, CH_3, H_2, and CH_4. Benzoquinone and ferric chloride have also been used to determine total radical yields. (auth)

16049

THE ACTION OF ^{60}Co γ-RADIATION ON AQUEOUS SOLUTIONS OF ACETYLENE. P. G. Clay, G. R. A. Johnson, and J. Weiss (Univ. of Durham, Eng.). *J. Phys. Chem.* 63, 862-6(1959) June.

Co^{60} γ irradiation of water saturated with acetylene (1 atm.) in the absence of oxygen yielded C_1, C_2, and C_4 aldehydes and a white solid polymer. The irradiated solution showed a very strong, broad absorption band with a maximum at about 200 mμ. Aqueous solutions of acetylene–oxygen mixtures, on irradiation, yielded glyoxal and hydrogen peroxide, with small amounts of an organic hydroperoxide (G ~ 0.3). The formation of the radiation products has been studied at different ratios of oxygen/acetylene, as a function of pH and in the presence of added ferrous sulfate. Under certain conditions, glyoxal is apparently formed by a chain reaction. (auth)

16050

α-RAY OXIDATION OF FERROUS SULFATE IN 0.4 *M* SULFURIC ACID SOLUTIONS. THE EFFECT OF 0 TO 0.4 *M* OXYGEN. Conrad N. Trumbore and Edwin J. Hart (Argonne National Lab., Lemont, Ill. and Univ. of Rochester, N. Y.). *J. Phys. Chem.* 63, 867-73(1959) June.

$G(Fe^{+++})$ has been measured as a function of dissolved oxygen concentration in ferrous sulfate solutions in 0.4 *M* sulfuric acid irradiated by the 5.3-Mev α particles of dissolved polonium-210. Studies on product yields with identical solutions containing no dissolved ferrous sulfate have been obtained and are used to explain the ferric ion yields. Both $G(H_2O_2)$ and $G(Fe^{+++})$ increase with increasing oxygen concentration, reaching yields of 1.9 and 9.8, respectively, at an oxygen concentration of 0.4 *M*. These results have been treated by diffusion theory. On the assumption that the radical–radical rate constant is 1.0×10^{-11} cc molecule^{-1} sec^{-1}, a rate constant is derived for $k_{(H + O_2)}$ of 2.5×10^{-12} cc molecule^{-1} sec^{-1}. Information is deduced regarding the relative rate constants for the reactions: $H + O_2 = HO_2$, k_1; $H + H = H_2$, k_2 and $HO_2 + HO_2 = H_2O_2 + O_2$, $k_8k_1 \sim k_2 >> k_8$. (auth)

16051

THE RADIOLYSIS OF ORGANIC SOLUTIONS. II. THE BENZOPHENONE–PROPANOL-2 SYSTEM. J. G. Burr and J. D. Strong (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). *J. Phys. Chem.* 63, 873-6(1959) June.

Mixtures of benzophenone with propanol-2 have been irradiated with cobalt-60 γ rays. It has been found that the yield of hydrogen from propanol-2 is very sensitive to benzophenone addition; 1% benzophenone lowers $G(H_2)$ from 3.0 to 2.0. Addition of benzophenone also lowers the yield of methane from propanol-2. It is concluded that benzophenone probably functions principally as a hydrogen atom scavenger. It was also observed that radiolysis of these mixtures produced benzpinacol with a G of 6.60 (as semi-pinacol units) concurrent with a disappearance of benzophenone with a G of 7.2 and the formation of acetone with a G of 9.1. It is concluded that hydrogen transfer between the components of a system composed of a ketone molecule solvated with carbinol molecules is an important factor in the formation of the pinacol. (auth)

16052

RADIOLYSIS OF LIQUID *n*-PENTANE. Adolf E. de Vries and Augustine O. Allen (Brookhaven National Lab., Upton, N. Y.). *J. Phys. Chem.* 63, 879-81(1959) June.

Product distribution in *n*-pentane radiolysis is the same for beams of 14-Mev He^{++} ions as for 2-Mev electrons, in marked contrast to the behavior of aqueous solutions. The various branched- and straight-chain products heavier than pentane contain little or no unsaturation and their relative yields are consistent with their being formed by random combination of free radicals produced by breakup of pentane without rearrangement. Hydrocarbon products lighter than pentane must be formed by some other mechanism. (auth)

16053

ON THE ADSORPTION OF SOME FISSION PRODUCTS ON VARIOUS SURFACES. J. Belloni, M. Haissinsky, and Halim N. Salama (Laboratorie Curie, Paris). J. Phys. Chem. 63, 881-7(1959) June.

The adsorption of promethium and tagged cerium and ruthenium from aqueous acid solutions has been studied on various surfaces. Certain apparently anomalous effects in the kinetics of the adsorption processes have been observed and interpreted. The quantities adsorbed at equilibrium increased with pH and, in most cases, passed through a maximum. The lanthanides obey the Langmuir isotherm, whereas the adsorption of ruthenium follows Henry's law. No temperature effect was observed on the adsorption of the lanthanides; the adsorption of ruthenium increases with temperature and is partly irreversible, whereas the adsorption of cerium and promethium is reversible. Possible mechanisms for these processes are discussed in the light of these results and those of other workers. (auth)

16054

THE REDUCTION OF CERIC IONS BY Po^{210} ALPHA PARTICLES. J. Weiss and N. Miller (Univ. of Edinburgh). J. Phys. Chem. 63, 888-9(1959) June.

Solutions of ceric sulfate, cerous sulfate, and thallous sulfate in 0.8N sulfuric acid were irradiated using a one-curie Po^{210} α source external to the solutions. The yield of ceric ion reduction was determined, and a qualitative explanation of the results given. The $G(Ce^{3+})$ without added solute was found to be 2.88 ± 0.02 for 3.4-Mev α particles. (auth)

16055

KINETICS OF THE RADIATION-INDUCED REACTION OF IRON(III) WITH TIN(II). J. W. Boyle, S. Weiner, and C. H. Hochanadel (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 63, 892-6(1959) June.

Cobalt γ rays induce reaction of Fe(III) with Sn(II). For dilute solutions in deaerated 0.4M H_2SO_4, the initial product yields per 100 e.v. of energy absorbed are G(Fe(II)) = 6.62, G(Sn(IV)) = 3.75, and $G(H_2) = 0.45$. Assuming the primary chemical species in the decomposition of water to be H, OH, H_2, and H_2O_2 produced with yields G_H, G_{OH}, G_{H_2}, and $G_{H_2O_2}$, the initial product yields are related to these quantities as follows: $G(Fe(II)) = G_H + G_{OH}$, $G(Sn(IV)) = G_{H_2O_2} + G_{OH}$, and $G(H_2) = G_{H_2}$. The initial yields indicate a mechanism in which Sn(II) is reduced by H to Sn(I) and oxidized by OH to Sn(III), Fe(III) is reduced by Sn(I) and Sn(III), and Fe(II) is oxidized by H_2O_2. The presence of Sn(II) in deaerated Fe(II) solutions lowers the yield for oxidation of Fe(II) and, at concentration ratios (Sn(II))/(Fe(II)) > 0.02, oxidation of Fe(II) is completely suppressed. Irradiation of deaerated Sn(II) solution produces Sn(IV) and H_2 with a yield 0.49 which is equivalent to G_{H_2}. On the basis of proposed mechanisms and the dependence of yields on relative concentrations, the following ratios of rate constants were evaluated: $k_{(Fe(II) + H)}:k_{(Sn(II) + OH)} = 1:7.0$; $k_{(Fe(II) + OH)}:k_{(Sn(II) + H)}:k_{(Sn(IV) + H)}:k_{(Fe(III) + H)} = 1:\sim 5000:0.16:0.081$; $k_{(Fe(II) + H_2O_2)}:k_{(Sn(II) + H_2O_2)} = 100:1$. The rapid rate of reduction of Sn(II) by H atoms is especially noteworthy. (auth)

16056

ON THE USE OF AQUEOUS SODIUM FORMATE AS A CHEMICAL DOSIMETER. T. J. Hardwick and W. S. Guentner (Gulf Research and Development Co., Pittsburgh). J. Phys. Chem. 63, 896-8(1959) June.

On radiolysis, sodium formate in aqueous solution gives products which may be quantitatively titrated with acid permanganate. This system is proposed as a chemical dosimeter in the range 1 to 80 Mrad and is particularly convenient for use in metal systems. The chemical change is proportional to the energy absorbed, and the yield of reductant (G = 3.40 mol. equiv./100 e.v.) is independent of dose rate, formate ion concentration over a wide range, and temperature. (auth)

16057

EFFECTS OF SOLUTE CONCENTRATION IN RADIOLYSIS OF WATER. Milton Burton and K. C. Kurlen (Univ. of Notre Dame, Ind.). J. Phys. Chem. 63, 899-904(1959) June.

Effects of halide scavenger on $G(H_2O_2)$ in aerated 0.8 N H_2SO_4 solutions irradiated in separate experiments with 24-Mev x rays, Co^{60} γ rays, 50-kev x rays, and 3.4-Mev alphas are in substantial agreement with the expanding-spur treatment of the theory of the radiolysis of water, both in the Ganguly–Magee form and in the earlier Magee form. On the other hand, G^0, the 100 e.v. yield of initial decomposition, seems to vary with velocity of the impingent particle in a manner not predicted by any current theory. Furthermore, there appears to be an inconsistency in the application of the present, necessarily simplified, theory to the results. The G^0 values found are significantly larger than those corresponding to the Ganguly–Magee model. At the same time, they suggest participation of both ionized and excited molecules in the radiolysis but to a degree considerably less than might be expected on the basis of the vapor phase result of Firestone. The latter is shown to correspond to the assumption that all primarily ionized and excited molecules contribute to the chemistry of the vapor. Apparently, part of the excitation energy is dissipated in the liquid state prior to decomposition to scavengeable free radicals. The results of experiments with 24-Mev x rays are qualitatively similar to, but quantitatively different from, those with Co^{60} γ rays. The expanding-spur theory would not in any presently existent treatment predict such a result. The specific rates of the scavenger reaction $X^- + OH \rightarrow X + OH^-$ have been calculated on the basis of the Ganguly–Magee model to be 1.6×10^{10} l $mole^{-1}$ sec^{-1} for Br^- and 4×10^9 l $mole^{-1}$ sec^{-1} for Cl^-. (auth)

16058

THE RADIATION-INDUCED POLYMERIZATION OF ISOBUTENE: A LIQUID PHASE IONIC REACTION. E. Collinson, F. S. Dainton, and H. A. Gillis (The University, Leeds, Eng.). J. Phys. Chem. 63, 909-15 (1959) June.

New evidence is presented in support of the suggestion that the γ-ray-induced polymerization of liquid isobutene at −78°C proceeds solely by a cationic mechanism. Attempts to polymerize isobutene at −78°C with free radicals from the photolysis of diacetyl, benzoin and benzil were unsuccessful but the benzil solution irradiated with ultraviolet light at 77°K was shown by electron spin resonance measurements to give rise to radicals from the isobutene. Isobutene irradiated in the pure state at a γ-ray dose rate of 7×10^{17} e.v. ml^{-1} min^{-1} polymerized with $G(-C_4H_8) = 3.0 \pm 1.7 \times 10^2$. Solutions of $FeCl_3$, DPPH, benzoquinone and iodine in isobutene were also irradiated with γ-rays. Of these solutes, only benzoquinone reduced the polymerization rate to zero, and DPPH had no significant effect. The effects of $FeCl_3$ and I_2 on the polymerization were complicated by other factors. The measured yields of conversion of the solutes after irradiation were G(–DPPH) = 3.7 ± 0.2, G(Fe(II)) = 3.0 ± 0.5 and G(–Q) = 1.5 ± 0.2. The electron spin resonance spectrum of isobutene irradiated with γ-rays at 77°K showed the presence of H atoms which disappeared rapidly, and a more stable radical, the spectrum of which consisted of 6 peaks having an over-all spacing of 158 gauss at the operating frequency of 9400 Mc sec.$^{-1}$. The same six peak pattern was obtained from cyclopropane irradiated with γ rays at 77°K and from a solution of benzil in isobutene irradiated with ultraviolet light at 77°K. It is concluded that the radical responsible for this spectrum is either the cyclopropyl radical or the methyl substituted allyl radical, the latter being the less likely. The most likely initiating ion is considered to be $(CH_3)_3C^+$, and a mechanism consistent with the available data is proposed. (auth)

16059

MASS SPECTROMETRIC STUDIES OF IONIC INTERMEDIATES IN THE α-PARTICLE RADIOLYSIS OF THE C_2 HYDROCARBONS. I. ACETYLENE. P. S. Rudolph and C. E. Melton (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 63, 916-18(1959) June.

Ionic intermediates from the α-particle radiolysis of acetylene were systematically studied as a function of pressure by magnetic mass separation of the ions. "Polymeric" ions, $C_4H_n^+$ and $C_6H_n^+$, have been identified and their per cent abundance determined. The most probable mechanisms for formation of the observed "polymeric" ions are evaluated. (auth)

16060

RECOIL REACTIONS WITH HIGH INTENSITY SLOW NEUTRON SOURCES. III. THE RADIATION DECOMPOSITION OF CRYSTALLINE $KBrO_3$. G. E. Boyd and J. W. Cobble (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 63, 919-25(1959) June.

The relative contributions of energetic neutrons and γ and β rays to the radiation decomposition of crystalline $KBrO_3$ in the Oak Ridge graphite pile were determined as approximately 20, 40, and 40%, respectively. Decomposition yields (i.e., "G"-values) for β rays and pile γ rays were 1.0 ± 0.1 molecule per 100 e.v. energy absorbed, while for energetic neutrons yields varying from 23 to 30, dependent on neutron energy, were found. The much greater efficiency for decomposition by fast neutrons was attributed to the mechanism whereby these particles transfer energy to bromate radicals. (auth)

16061

RADICAL PRODUCTION IN HYDROCARBONS BY HEAVY PARTICLE RADIATIONS. Robert H. Schuler (Mellon Inst., Pittsburgh and Brookhaven National Lab., Upton, N. Y.). J. Phys. Chem. 63, 925-8(1959) June.

Previous experiments on the use of iodine to scavenge radicals produced in hydrocarbons by γ rays have been extended to the heavy particle radiations available at the Brookhaven 60-inch cyclotron. It has been shown that at beam currents of the order of 10^{-9} ampere depletion effects can be avoided in millimolar iodine solutions and that significant radical yields can be determined. Hexane, cyclohexane, and 2,2,4-trimethylpentane were studied. In experiments with 18-Mev deuterons (LET = 0.5 e.v./A) and with 33-Mev helium ions (LET = 2 e.v./A) the observed yields are approximately 10 and 30% less than those found in similar fast electron experiments. This decrease in radical yield is somewhat less than observed in similar comparisons of the effect of light and heavy particles on aqueous systems. (auth)

16062

HYDROGEN ATOMS IN THE RADIOLYSIS OF WATER. Nathaniel F. Barr and Augustine O. Allen (Brookhaven National Lab., Upton, N. Y.). J. Phys. Chem. 63, 928-31 (1959) June.

In the radiolysis of aqueous solutions containing H_2, H_2O_2, and O_2, the "H atom" formed by free-radical oxidation of H_2 is shown to react with O_2 much faster than with H_2O_2; but in solutions containing O_2 and H_2O_2 only, the "H atom" formed from water by radiolysis attacks O_2 and H_2O_2 at comparable rates. It is concluded that the two kinds of "H atom" are in fact different, and may be basic and acid forms of H, i.e., the solvated electron, or the ion H_2^+. (auth)

16063

APPLICATION OF OPTICAL ROTATION MEASUREMENTS IN STUDYING THE STRUCTURAL DEGRADATION OF γ-IRRADIATED OVALBUMIN. Hugo Fricke, Wendell Landmann, Charles Leone, and James Vincent (Argonne National Lab.. Lemont, Ill.). J. Phys. Chem. 63, 932-5(1959) June.

Earlier work led to the conclusion that ovalbumin treated with high-energy radiations contains a broad range of protein molecules in various stages of structural breakdown. This view has now been supported by optical rotation studies on solutions of ovalbumin after treating in the lyophilized state, under vacuum, with γ rays. The specific levorotation $-[\alpha]_{5461}^{5}$ of the isoelectrically coagulable fraction and of three thermolabile fractions of increasing stability obtained from ovalbumin treated with 58.5 electronic volts per protein molecule, were found to be 60.2, 47.7, 42.1, and 39.5°C, respectively, as compared to 85.0°C for ovalbumin denatured by heating at pH 7.2 and 36.9°C for the native protein. These values for the specific levorotations of the various fractions are discussed with reference to the serological activities of these same fractions, as measured by their reaction with antinative rabbit serum. (auth)

16064

THE EFFECT OF α-RADIATION ON AQUEOUS GLYCINE. Charles R. Maxwell and Dorothy C. Peterson (National Cancer Inst., Bethesda, Md.). J. Phys. Chem. 63, 935-8(1959) June.

Oxygen-saturated and oxygen-free 1 M solutions of glycine have been irradiated with α particles from an exterior Po^{210} source. Yields of HCHO, NH_3, HCOCOOH, and H_2O_2 are reported as a function of dose. The relative yields of these compounds are quite different from those previously reported for x rays. The specific yields of these products are greater, particularly in the oxygen-saturated solutions, than would be predicted by an indirect free radical mechanism in the bulk of the solution. (auth)

16065

THE KINETIC RADIATION EQUILIBRIUM OF AIR. P. Harteck and S. Dondes (Renssalaer Polytechnic Inst., Troy, N. Y.). J. Phys. Chem. 63, 956-61(1959) June.

A study was made of the irradiation of nitrogen–oxygen mixtures near and at the kinetic radiation equilibrium, i.e., the steady state of formation and decomposition of the constituents. Air and two to one nitrogen to oxygen mixtures showed that under proper irradiation conditions, all the oxygen is consumed to form nitrogen dioxide and nitrous oxide and, in some cases, a small surplus of nitric oxide remained. The kinetics of the nitrogen—oxygen system at the equilibrium is explained. (auth)

16066

THE HYDROGEN-DEUTERIUM EXCHANGE ACTIVITY AND RADIATION BEHAVIOR OF SOME SILICA CATALYSTS. Harold W. Kohn and Ellison H. Taylor (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 63, 966-70 (1959) June.

Catalytic activity for H_2-D_2 exchange has been found in all of the types of silica examined, gel, quartz, α-cristobalite, vitreous and amorphous. The activity per unit surface differs widely, being highest for quartz and vitreous silica. Since these were prepared by grinding, the high activity may have been introduced by that process. The activity observed immediately after activation declines by a factor of ten or more over ten days, and more slowly for several weeks. Irradiation with γ rays or neutrons produces a dramatic increase in the activity of these silicas. The activation energy with the gel is reduced by irradiation from about 9 to about 2 kcal/mole. Quartz and vitreous silica show low activation energies even before irradiation. The enhanced activity declines with time, but at a rate indistinguishable from that of the unirradiated materials. The activity obtained by irradiation has not been equalled in an unirradiated catalyst by any activation procedure. With the low activation energies observed, only a small number of sites is needed to explain the increases in activity. Since the yields of sites are likewise small, a primary process of low probability, such as atom displacement, is suggested. The activity per displaced atom is even lower for the neutron bombardments. Within rather large uncertainties, the activity increase per unit dose is nearly equal for the different types of silica. Three silica-alumina hydrocarbon cracking catalysts behaved much like the silicas. The similarities shown by the different silicas (and silica-alumina) may mean that the local arrangement of silicon and oxygen atoms is responsible for the catalytic activity, for the only common feature of the structures is the silicon—oxygen tetrahedron. (auth)

16067

INTENSITY AND CONCENTRATION DEPENDENCE OF SOME RADIATION-INDUCED REACTIONS IN ANTHRACENE SOLUTIONS. A. Charlesby, W. H. T. Davison, and D. G. Lloyd (Royal Military Coll. of Science, Swindon, Eng. and T. I. Research Labs., Saffron Walden, Eng.). J. Phys. Chem. 63, 970-5(1959) June.

Dilute solutions of anthracene in hexane, cyclohexane, and polysiloxanes were subjected to gamma and electron radiation, and the effect of anthracene concentration and radiation intensity on the rate of disappearance of anthracene studied. The results obtained have been compared with two alternative reaction schemes. In the case of the hydrocarbon solutions, the rate of loss of anthracene depends on $A\sqrt{I}$, as is to be expected from a competitive reaction between anthracene—radical and bimolecular radical—radical combination or disproportionation, where the radicals are initially distributed at random. In the case of the siloxanes, the absence of the expected radiation intensity effect implies that the radicals formed in siloxanes are removed unimolecularly in the absence of an additive. The implication of these results on current theories of the cross-linking of polymers is discussed. (auth)

16068

A NOTE ON THE RADIATION INDUCED SYNTHESIS OF A LAUTH'S VIOLET. P. Balestic and M. Magat (Faculté des Sciences, Paris). J. Phys. Chem. 63, 976-8(1959) June.

It is established by spectroscopic and chemical evidence that γ-ray irradiation of aerated aqueous solutions of p-phenylenediamine and H_2S at pH > 1 leads to a formation Lauth's Violet. Methods for isolation and purification of the dye formed are described. Some preliminary kinetic results are given. (auth)

16069

TETRANITROMETHANE AS A RADICAL SCAVENGER IN RADIATION CHEMICAL STUDIES. A. Henglein, J. Langhoff, and G. Schmidt (Univ. of Cologne). J. Phys. Chem. 63, 980(1959) June.

16070

ISOTOPIC EXCHANGE BETWEEN ETHERS AND DEUTERIUM ON METALLIC CATALYSTS. Joan M. Forrest, Robert L. Burwell, Jr., and Benjamin K. C. Shim (Northwestern Univ., Evanston, Ill.). J. Phys. Chem. 63, 1017-21(1959) June.

The oxygen atom of an ether blocks the propagation of the isotopic exchange reaction between an ether and deuterium on a rhodium, a palladium, and a nickel catalyst. For example, in one period of residence on the surface, the most exchanged product of propyl ether is $C_3D_7OC_3H_7$. A large part of the rhodium surface is covered with ether adsorbed at the oxygen atom. This species does not lead to exchange and much reduces the rate of exchange of the ether. The presence of an ether markedly reduces the rate of exchange of alkanes introduced with or just after an ether. Sweeping the catalyst with hydrogen at reaction temperatures (usually 150°) restores the original rate of alkane exchange. The presence of an ether alters the shape of the isotopic distribution pattern of heptane and probably that of cyclopentane. Isotopic distribution patterns are reported for propyl, isopropyl, ethyl butyl, methyl amyl, and methyl sec-butyl ether, tetrahydrofuran and dioxane. (auth)

16071

THE PHOTOLYTIC PREPARATION OF URANIUM TETRAFLUORIDE. D. Patnaik and Balaram Sahoo (Ravenshaw Coll., Cuttack, India). Proc. Indian Acad. Sci., Sec. A 49, 200-2(1959) Apr.

A simple and convenient method for the preparation of uranium tetrafluoride utilizing solar energy was described. The advantage of this method is that no foreign substance is used for bringing about the reduction of uranium (VI) to uranium (IV) valency state. When a solution of uranyl formate or uranyl nitrate in hydrofluoric acid and alcohol is exposed to sunlight, a bright green precipitate of uranium tetrafluoride settles down. Photolysis under similar conditions using ammonium bifluoride in place of HF gives the complex $NH_4F \cdot UF_4 \cdot H_2O$. (auth)

16072

CHEMICAL EFFECTS OF RADIATION. F. S. Dainton (Univ. of Leeds, Eng.). Radiation Research Suppl. No. 1, 1-25(1959).

The principal features of the radiation chemistry of aqueous systems are presented in chart form. While crudities and oversimplifications are obvious, the chart serves to focus attention on the major features. Included are a critical history of recent researches on the radiation chemistry of aqueous systems, chemical methods of determining G values of primary products a review of recent experimental results concerning the yields of the primary products and a discussion of the influence of the state of aggregation on results. 41 references. (C.H.)

16073

SOME OBSERVATIONS ON THE BIOCHEMICAL EFFECTS OF X-RADIATION. L. A. Stocken (Oxford Univ.). Radiation Research Suppl. No. 1, 53-72(1959).

Difficulties encountered in attempting to assess or compare the available experimental data on biochemical effects of radiation are reviewed. Topics discussed in detail include enzyme inactivation, oxidation and phosphorylation reactions, and the response of nucleic acids to radiation. Nuclear-cytoplasmic interactions are considered, and it is concluded that recovery of the cell will depend on the ability of its cytoplasm to overcome the nuclear damage. If cells in some vital tissue are unable to overcome the defect, death of the animal must ensue. 114 references. (C.H.)

16074

EVIDENCE FOR OXYGEN INTERMEDIATES IN GASES, LIQUIDS, AND SOLIDS. P. A. Giguère and J. A. Herman (Laval Univ., Quebec). Radiation Research Suppl. 1, 149-63(1959).

The role of oxygen intermediates in radiation chemistry is discussed. The survey is restricted to physical evidence of the role of oxygen atoms and hydroxyl radicals in gases, liquids, and solids. Evidence is presented which was obtained by means of spectroscopy, microwave spectra, study of the emission spectra in flames, mass spectrometry, paramagnetic resonance, calorimetry, and other methods. 108 references. (C.H.)

16075

OXYGEN EFFECTS IN PHOTOCHEMICAL SYSTEMS. W. Albert Noyes, Jr. (Univ. of Rochester, N. Y.). Radiation Research Suppl. 1, 164-76(1959).

The present state of knowledge of oxygen effects in photochemical systems is reviewed. Emphasis is placed on oxygen effects involving simple organic molecules. Steps which must be taken to elucidate steps in oxidation reactions are discussed. Topics covered in detail include reactions of radicals with oxygen and reactions of energy-rich molecules with oxygen. It is concluded that oxygen will not suppress completely certain reactions due to hot radicals. Primary photochemical dissociations of many molecules seem to occur mainly from the singlet state produced by the initial absorption act and from a triplet state formed from the singlet state by secondary reactions. Details of the complete mechanism are not yet fully understood. 63 references. (C.H.)

16076

OXYGEN EFFECTS AND FORMATION OF PEROXIDES IN AQUEOUS SOLUTIONS. George Scholes and Joseph Weiss (Univ. of Durham, Eng.). Radiation Research Suppl. No. 1, 177-89(1959).

The present status of knowledge of the chemical action of ionizing radiations on aqueous systems and the action of ionizing radiations on water are reviewed. Physical and chemical primary processes in the action of radiation on water, the role of molecular oxygen in radiation-induced reactions, the radiation-induced formation of hydroperoxides, and oxygen effects with densely ionizing radiations are discussed. It is concluded that the chemical effects of ionizing radiations on aqueous systems can be considerably influenced by the presence of molecular oxygen. 22 references. (C.H.)

16077

OXYGEN AND PEROXIDE EFFECTS IN THE RADIATION CHEMISTRY OF ORGANIC LIQUIDS. N. A. Bach (Academy of Sciences, U.S.S.R., Moscow). Radiation Research Suppl. No. 1, 190-203(1959).

Irradiation of organic substances in the presence of oxygen always leads to the occurrence of oxidation processes. The development of radiation-induced oxidation, which may be characterized by the yields of products, is favored by the presence of a double bond, by enhanced mobility of hydrogen atoms due to the influence of definite functional groups, by a straight-chain structure as compared with branched and cyclic molecules, particularly aromatic, and by other factors. Depending on the properties of the irradiated substance, the oxidation processes may develop according to chain or nonchain mechanisms. The latter point depends not only on the nature of the irradiated substance but also on the ambient temperature. With increasing temperature nonchain reactions tend to develop into chain processes, while thermal chain reactions may be very efficiently stimulated by ionizing radiations under certain conditions. In any given instance one must always keep in mind the possibility of utilizing radiation with positive aims and the necessity of suppressing its deleterious effects. This is particularly important in the case of oxidation reactions, owing to their prominent role in biological systems and their potentialities in industrial processes. It is urgent to learn how to regulate radiation-induced oxidation, in order, on the one hand, to develop desirable reactions in chemically inert substances and, on the other hand, to inhibit noxious effects. (auth)

16078

OXYGEN AND PEROXIDE EFFECTS IN ORGANIC SOLIDS. Michel Magat (Laboratoire de Chimie Physique, Paris). Radiation Research Suppl. No. 1, 204-15(1959).

A general scheme is presented for the radioinduced oxidation of solid polymers. Mechanisms in propagation reactions and scission reactions are discussed. Experimental results on the radiation-induced oxidation of solid polymers are presented. Results are reported from studies of radiation-induced oxidation of polyethylene, the peroxidation of polypropylene, and the oxidation of other solid polymers. It is obvious from the experimental results quoted that the general scheme of autoxidation reactions established for smaller molecules is valid also for solid synthetic polymers irradiated in the presence of air. The influence of the geometry of the sample, the permeability of the polymer, the oxygen pressure, and temperature on results are discussed. 33 references. (C.H.)

16079

CHANGES INDUCED IN NUCLEIC ACIDS BY IONIZING RADIATIONS AND CHEMICALS. J. A. V. Butler (Royal Cancer Hospital, London). Radiation Research Suppl. No. 1, 403-16(1959).

The structure of desoxyribonucleic acid (DNA) and desoxyribonucleoproteins is described. Physical and chemical changes induced by the actions of ionizing radiations are discussed. Effects on isolated and in vivo DNA are considered. Direct and indirect effects are compared. The effects of radiomimetic chemicals on isolated and in vivo DNA are also described. (C.H.)

16080

ON THE TARGET SIZE OF A TRANSFORMING FACTOR BASED ON X-RAY INACTIVATION. Raymond Latarjet, Harriett Ephrussi-Taylor, and Nicole Rebeyrotte (Université, Paris). Radiation Research Suppl. No. 1, 417-30(1959).

The complex nature of the radiation-induced inactivation of desoxyribonucleic acid (DNA) is discussed. Results are reviewed from a number of different experiments, and factors affecting the reproducibility of the inactivation curve are considered. Factors entering into calculation of the target and the protective action of organic material in the frozen state are discussed. (C.H.)

16081

APPLICATION OF FLASH PHOTOLYSIS IN IRRADIATION STUDIES. George Porter (Univ. of Sheffield, Eng.). Radiation Research Suppl. No. 1, 479-90(1959).

Flash photolysis is a method whereby a nonequilibrium situation can be created in a reaction system in a short interval of time. It provides a general means of preparing unstable intermediates in concentrations higher than can be obtained by other methods. It is applicable to gases, liquids, and solids and to the whole available temperature range. Applications of flash photolysis to irradiation studies are summarized. The experimental method is described, and limitations and difficulties of flash photolysis are discussed. 34 references. (C.H.)

16082

ELECTRON SPIN RESONANCE OF FREE RADICALS IN IRRADIATED BIOCHEMICALS. Walter Gordy (Duke Univ., Durham, N. C.). Radiation Research Suppl. No. 1, 491-510(1959).

Applications of paramagnetic resonance for the study of radiation effects are reviewed. The feature which makes electron magnetic resonance a natural method for the study of radiation damage to solids, or of free radicals within solids, is the fact that the method does not detect electrons of ordinary matter which have their magnetism canceled by pairing but detects only electrons knocked apart, as unpaired, by ionizing radiations or other means. The electron spin resonance patterns produced by x irradiation was determined for some twenty-five amino acids and a comparable number of di- or tripeptides and a large number of proteins. This survey showed that the electron spin resonance method is almost universally applicable to the study of biochemicals in the solid state. Results are reported from applications of electron spin resonance to studies on proteins and their constitutents, biological tissue treated with cysteine, cell components, human hemoglobin, thyroid and parathyroid extracts, steroids, and nucleic acids and their constituents. The effect of oxygen on the paramagnetic resonance signals of different types of irradiated biochemicals was also investigated. 22 references. (C.H.)

16083

EVIDENCE FOR FREE-RADICAL PRODUCTION IN LIVING CELLS EXPOSED TO IONIZING RADIATION. K. G. Zimmer (Univ. of Heidelberg, Ger. and Reactor-Station Karlsruhe, Heidelberg and Karlsruhe, Ger.). Radiation Research Suppl. No. 1, 519-29(1959).

Applications of microwave spectroscopy as an index of the presence of free radicals in specimens of biological materials are discussed. The importance is stressed of this analytical tool in the search for mechanisms of the biologic action of radiation. Qualitative microwave spectroscopy is concerned with determining the type of free radical formed by irradiation and usually requires a detailed analysis of hyperfine structure. Many interesting results have been obtained by this method in investigating irradiated biochemicals such as amino acids, proteins, and nucleic acids. Quantitative microwave spectroscopy yields information on the number or concentration of free radicals as a function of radiation dose and dose rate, of time after irradiation, and of external conditions such as temperature and water content of the specimen or type and pressure of the surrounding gas. This method was applied to biochemicals and also to living cells exposed to ionizing radiation. Details of the experimental technique are summarized. Results are presented from studies on irradiated glycine, irradiated barley embryos, and irradiated seeds with various water contents. 15 references. (C.H.)

16084

COLLISION CROSS-SECTION STUDIES ON MOLECULAR GASES AND THE DISSOCIATION OF OXYGEN AND WATER. Edwin N. Lassettre (Ohio State Univ., Columbus). Radiation Research Suppl. No. 1, 530-46(1959).

A review is presented of results from recent studies on the excitation of molecular gases by electron impact. Emphasis was placed on those phases of the research that deal specifically with the connection between excitation by radiation absorption and by electron impact. Results are reported from studies on the Schuman-Runge continuum of oxygen, the oxygen spectrum at excitation energies from 10 to 80 ev, and the inelastic scattering of electrons by water. Attention was concentrated on the study of electrons scattered from an initially collimated beam which is approximately homogeneous in energy. The theory of scattering is discussed. Design features are described for two electron spectrometers used in the studies. The theory outlined was tested by the comparison of electron impact and ultraviolet absorption spectra for a variety of substances and by the determination of generalized oscillator strengths for both resolved transitions, and continua. Data are tabulated for methane, argon, hydrogen, oxygen, and water. A brief survey of these and other results is presented. 34 references. (C.H.)

16085

CHEMISCHE REAKTIONEN IONISIERENDER STRAHLEN (RADIATION CHEMISTRY). (Chemical Reactions of Ionizing Radiation (Radiation Chemistry). Hermann Mohler, ed. Frankfurt am Main, Verlag H. R. Sauerlander and Co., 1958. 299p.

A series of lectures given at the University of Basel on production of chemical reactions by high energy radiation and sponsored by several industrial firms has been expanded into a book for the chemist and methods engineer. The first chapter is an introduction to the reactions of high-energy radiation with matter. Radiation sources is the subject of the second chapter with a consideration of Van de Graaff generators, linear accelerators, and reactors and radioactive sources. The third chapter, on dosimetry, discusses conventional, practical, chemical, and calorimetric dosimetry. The fundamentals of chemical radiation effects are reviewed in the fourth chapter. In the fifth chapter effects of atomic radiation on polymers are considered. Radiation-induced reactions of potential industrial importance are reviewed in the final chapter. (J.S.R.)

Separation Processes for Pu and U

16086 ANL-6011
Argonne National Lab., Lemont, Ill.
PREPARATION OF YTTRIUM FLUORIDE IN FLUIDIZED BEDS. Irving E. Knudsen and Norman M. Levitz. May 1959. 14p. Contract W-31-109-eng-38. $0.50 (OTS).

The batch fluid-bed hydrofluorination of yttrium oxide to yttrium fluoride of low residual oxygen content was studied in a 3-inch Monel column. Bed temperature, hydrofluorination time, and hydrofluoric acid excess were studied, and the contamination due to equipment corrosion was determined. A sample of the fluoride was converted to metal and analyzed for impurities. A brief investigation of the reaction kinetics was also made on the thermobalance. (auth)

16087 BMI-1348
Battelle Memorial Inst., Columbus, Ohio.
CONSTRUCTION MATERIALS FOR THE HYDROFLUORINATOR OF THE FLUORIDE-VOLATILITY PROCESS. Paul D. Miller, Charles L. Peterson, Oliver M. Stewart, Elmer F. Stephan, and Frederick W. Fink. June 3, 1959. 44p. Contract W-7405-eng-92. $1.50 (OTS).

Fuel elements clad with Zr or containing Zr as a diluent can be recovered by a fluoride-volatility process. The first step consists of hydrofluorination of the elements in a bath of molten fluoride salts using an HF sparge. In this case the two salt systems considered were $NaF-ZrF_4$ and NaF−LiF. Materials evaluated at Battelle for possible use in the construction of this hydrofluorinator include Inconel, "A" Nickel, copper, silver, Monel, Hastelloy B, Hastelloy W, INOR-1, and INOR-8. The metals were exposed to molten fluoride salts through which HF was bubbled continuously. The data indicate that the NaF−LiF systems are much more corrosive than the $NaF-ZrF_4$ system. The systems are most corrosive when the alkali fluoride component is high. An elevation in temperature increases the corrosion significantly as does an increase in the HF flow rate. Hydrogen in the HF flow stream retards the corrosion of the sodium−zirconium salts significantly, but appears to have less effect on the sodium−lithium systems. The areas at the interface of the liquid and vapor phases were most seriously damaged under the exposure conditions usually used. However, appreciable reduction in attack was experienced when zirconium was actually hydrofluorinated. INOR-8 was the most promising of the materials evaluated. (auth)

16088 CF-58-10-126(Rev. I)
Oak Ridge National Lab., Tenn.
EUROCHEMIC ASSISTANCE: ANALYTICAL. L. T. Corbin. June 23, 1959. 5p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

Information on the analytical requirements for a combination control and development laboratory which is to be associated with a Purex-type solvent extraction processing plant is presented. Additional comments by personnel of the ORNL Analytical Chemistry Division on questions directed to them for the Eurochemic Assistance Program are also given. (J.R.D.)

16089 CF-58-11-51(Rev.1)(Del.)
Oak Ridge National Lab., Tenn.
TRIP REPORT—EUROCHEMIC COMPANY ASSISTANCE—HANFORD ATOMIC PRODUCTS OPERATION SPENT FUEL PROCESSING TECHNOLOGY. E. M. Shank. June 23, 1959. 21p. $3.30(ph), $2.40 (mf) OTS.

Information obtained from HAPO during visit by M. K. Twichell, UCNC, and E. M. Shank, ORNL, is given. Included are the tentative procedures for obtaining and transmitting information to the Eurochemic company. Discussions are given on pulsed columns, corrosion, pulse generators, centrifuges, valves, in-line instrumentation, evaporators, resin column design, off-gas processing, solvent recovery, liquid-waste handling, process control, equipment decontamination, criticality, radiation protection, diluent, and solvent stability, backmixing in a pulsed column, and use of 40% TBP in the purex flowsheet. (auth)

16090 CF-59-3-91(Rev.1)
Brookhaven National Lab., Upton, N. Y. and Oak Ridge National Lab., Tenn.
EUROCHEMIC ASSISTANCE PROGRAM: COMMENTS BY BNL, DATED FEBRUARY 17, 1959, ON EUROCHEMIC DOCUMENTS. B. Manowitz. June 25, 1959. 3p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

Eurochemic reports were reviewed by BNL personnel concerning aqueous reprocessing, and several comments are offered for process improvements. Also, pertinent BNL documents related to waste and head end processes and corrosion are listed. (J.R.D.)

16091 IDO-14472
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
ICPP INPUT MEASUREMENT PROGRAM. F. H. Tingey and J. E. Rein. May 25, 1959. 49p. Contract AT(10-1)-205. $7.80(ph), $3.30(mf) OTS. (PTR-368).

The measurement of residual fissionable material in spent reactor fuel elements requires specialized equipment, methods, and control procedures. As a result of processing a variety of fuels at ICPP an integrated measurement generation, control and interpretation system has evolved which provides highly precise measurements from which plant material balances are constructed. (auth)

16092 ORNL-2690
Oak Ridge National Lab., Tenn.
RECYCLE OF UO_2F_2 IN THE FLUOROX PROCESS: REACTION OF UO_2F_2 WITH HYDROGEN. L. M. Ferris and R. P. Gardner. July 9, 1959. 16p. Contract W-7405-eng-26. $0.75(OTS).

The reaction of UO_2F_2 with hydrogen at 700 to 850°C was briefly investigated since it could constitute a major step in the recycle of UO_2F_2 in the Fluorox process. The reaction in this temperature range proceeds according to the equation $UO_2F_2 + H_2 \longrightarrow UO_2 + 2\ HF$. Rates of the chemical reaction were not obtained, since, with the thermogravimetric technique used, the rate-controlling process was bed diffusion. However, there is no doubt that the rate of chemical reaction is sufficiently high for the desired application. No significant amount of UF_4 was formed by the back-reaction, $UO_2 + 4\ HF \longrightarrow UF_4 + 2\ H_2O$. (auth)

16093 SRS-94
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE SOLVENT EXTRACTION OF URANYL NITRATE. H. A. C. McKay. Feb. 15, 1954. 6p.

A general review of work on the solvent extraction of uranyl nitrate is presented. (J.E.D.)

16094
PROCESSING OF IRRADIATED REACTOR FUELS. EFFECT OF DIBUTYL PHOSPHATE IN THE TRIBUTYL PHOSPHATE PROCESSING SYSTEM. W. W. Morgan, W. G. Mathers, and R. G. Hart (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Ind. Eng. Chem. 51, 817-20(1959) July.

Separation of Pu and U by use of a contactor which takes advantage of the partition differences of Pu(IV) and U(IV) in dilute HNO_3, or by selectively reducing Pu(IV) to Pu(III) and taking advantage of the gross partition differences of Pu(III) and U(IV) is discussed. A study to achieve this separation in a single contactor using a Pu stripping stream which introduces no foreign materials such as ferrous ions to the product stream was conducted. Trace quantities of dibutyl phosphates have deterimental effects on separation. Practical methods were evolved for overcoming difficulties and producing, in a single cycle, a U product with a U to Pu wt. ratio of 10^8 to 1. (J.R.D.)

16095
PHYSICAL METHODS OF URANIUM ORE ENRICHMENT. Josef Kortus and Radomil Salášek (Chemical Project, Prague). Jaderná energie 5, 45-50(1959). (In Czech.)

Radiometric separation, gravitational separation (in medium of water or in heavy suspensions), and flotation treatments are considered for treatment of uranium ores. A short review of new data presented at the second Geneva conference is included. (auth)

16096
SEPARATION OF MULTI-CURIE KRYPTON-85. E. J. Wilson and K. J. Taylor (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Eng. 4, No. 37, 110-11(1959) May.

An apparatus is described which is capable of producing 25 curies of krypton-85 each working day from a starting material containing 10 ppm. (A.C.)

16097
IMPROVEMENTS IN OR RELATING TO METHOD FOR PREPARING METAL SALT SOLUTIONS. Thomas Victor Healy (to United Kingdom Atomic Energy Authority). British Patent 814,568. June 10, 1959.

Uranyl nitrate in dilute HNO_3 can be converted completely to sulfate by adding H_2SO_4 equivalent to the $UO_2(NO_3)_2$ and boiling with formaldehyde. (T.R.H.)

CONTROLLED THERMONUCLEAR PROCESSES

16098 NP-7612
Defense Atomic Support Agency, Washington, D. C.
SUMMARY OF SHERWOOD ACTIVITIES. Supplement No. 2. Charles W. Hulburt. May 13, 1959. 10p.

Information in this report supplements AFSWP-1072 and AFSWP-1092.

Problems associated with controlled thermonuclear reactions are discussed. Experimental devices covered are: Stellarator, Columbus II, Perhapsatron S-3, and DCX. (W.L.H.)

16099 NYO-7891
Princeton Univ., N. J. Project Matterhorn.
STABILITY OF D.C. POWER SUPPLY—GENERAL ELECTRIC PROPOSAL P-5935. Technical Memorandum No. 33. John Murray, Peter Warter, and Daniel Wells. Apr. 22, 1957. 27p. \$6.30(ph), \$3.00(mf) OTS.

The stability of the C Stellarator power supply as outlined in General Electric Company proposal P-5935 was investigated to determine whether the system can be controlled in the prescribed manner. This investigation showed that a motor-generator set with feedback control, using components described, is capable of producing the desired results. (A.C.)

16100 NYO-8750
Princeton Univ., N. J. Project Matterhorn.
THE APPLICATION OF ULTRA-HIGH VACUUM TECHNIQUES TO CONTROLLED THERMONUCLEAR DEVICES. Scientific Publication No. 14. D. J. Grove. [Oct. 1958]. 29p. Contract [AT(30-1)-1238]. \$4.80 (ph), \$2.70(mf) OTS.

Text of paper given at Fifth National Vacuum Symposium, San Francisco, Oct. 23, 1958.

A discussion is given of the role played by impurities in the operation of controlled thermonuclear devices. There follows a description of ultra-high vacuum techniques as applied to experimental Stellarator devices. The results of these efforts are described in terms of machine operation before and after achieving UHV. A brief description is given of future prospects. (auth)

16101 RISÖ-5
Denmark. Atomenergikommissionen. Forsögsinstitut Risö.
ON THE EFFECTS ON A STEADY STATE THERMONUCLEAR REACTION OF FINITE ENERGY TRANSFER RATES BETWEEN THE CHARGED PARTICLES. T. Hesselberg Jensen and F. Heikel Vinther. Mar. 1959. 30p.

In previous reports it was assumed that the energy transmission rate between charged particles was infinite, leading to the assumption that the particles form a Maxwell distribution. Characteristic times for the deuterium plasma are estimated. This estimate shows that in one part of the parameter intervals of main interest for controlled thermonuclear reactions, the assumption of infinite energy transfer rates between the charged particles is a fairly good approximation. In another part the estimate shows that the assumption is not good, but that it is more reasonable to assume three groups of particles, namely a Maxwell distribution of all electrons, a Maxwell distribution of nearly all ions, and a distribution of energetic charged reaction products slowing down. Under this assumption parameter sets giving self-sustaining conditions are found in two cases, namely, when the plasma is fed with pure deuterium and when the plasma is fed with equal amounts of deuterium and tritium. Only under self-sustaining conditions can results from this and the previous reports be directly compared. Comparing cases with equal ion temperatures, changes due to this more realistic assumption are found to be small. It can, however, be seen qualitatively that outside the parameter regions of self-sustaining conditions, changes can be great. (auth)

16102 UCRL-5045
California. Univ., Livermore. Radiation Lab.
PYROTRON PLASMA-HEATING EXPERIMENTS. F. H. Coensgen and F. C. Ford. May 6, 1958. 18p. Contract W-7405-eng-48. \$3.30(ph), \$2.40(mf) OTS.

R. F. Post has proposed that an ionized gas (plasma) can possibly be contained in a linear magnetic field of circular symmetry. The motion of charged particles along the magnetic lines is to be limited by strong fields (magnetic mirrors) at the ends of the system. The properties of a plasma in such a field configuration are discussed from the premise that an individual charged particle of a tenuous plasma will behave as an isolated ion. Experiments show that a plasma can be compressed by a pulsed magnetic field and that the plasma column moves as predicted. There is evidence of electron heating. However, it has not been shown that the heating follows the adiabatic law. (A.C.)

CRITICALITY STUDIES

16103 AERE-R/R-2703
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
CRITICAL ASSEMBLIES WITH HEAVY WATER SOLUTIONS OF URANYL FLUORIDE (H.A.Z.E.L.). PART 2. PHYSICS. J. R. Harrison, M. F. Smith, W. G. Clarke, A. M. Mills, and J. A. Dyson. Nov. 1958. 67p. $1.96 (BIS).

Details are given of a series of critical assemblies and flux measurements undertaken in HAZEL using 46% U^{235} as UO$_2$F$_2$ in D$_2$O in cylindrical geometry. The fissile concentrations investigated were in the range 1939 to 6722 D/U$_F$, and in the geometry considered (2 inch diameter steel cylinder), the critical heights were in the range 70 to 200 cms. The minimum critical mass was 1.768 kg of U^{235} occurring at a concentration of 4687 D/U$_F$. (auth)

16104 CF-59-6-45
Oak Ridge National Lab., Tenn.
A COMPARISON OF ELEMENTARY CRITICALITY CALCULATIONS WITH EXPERIMENTAL RESULTS. C. W. Nestor, Jr. June 11, 1959. 15p. $3.30(ph), $2.40(mf) OTS.

Several experiments have been performed at ORNL with light water solutions of uranyl nitrate (highly enriched in either U^{233} or U^{235}) in an essentially bare sphere 27 inches in diameter. Results are presented of several calculations with elementary bare reactor theory and a discussion of the observed discrepancies between the calculated and experimental results. If the observed critical concentration is used in the calculations, the calculated effective multiplication constant is less than unity; thus a higher critical concentration would be predicted than is actually observed. (auth)

16105 CRRP-845
Atomic Energy of Canada Ltd., Chalk River, Ont.
CRITICALITY EXPERIMENTS WITH NRU RODS AT VARIOUS SPACINGS. D. W. Hone, R. M. Pearce, and L. Pease. May 1959. 15p. (AECL-818). $0.50(AECL).

This work first appeared in Chalk River report RDP-55, May 1953.

Rods designed for the 200 Mw research reactor NRU were studied at low power in the heavy-water moderated critical-facility ZEEP. The buckling and the distribution of the thermal neutrons in a cell have been measured for various lattice spacings. NRU lattice constants are deduced from these measurements. The uniform temperature coefficient of reactivity was measured at one spacing. (auth)

16106 IGR-72(RD/R)
United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.
A COMPARISON OF THREE METHODS OF CALCULATING THE CRITICAL LAPLACIANS OF FULLY REFLECTED RECTANGULAR AND FINITE CYLINDRICAL REACTORS. M. A. Perks. 16p. $0.42(BIS).

The critical Laplacians (or bucklings) of fully reflected rectangular and finite cylindrical reactors are found by a new method called the Method of Optimized Parameters. The results obtained by this method are compared with those found by a Standard Approximate Solution and also by Ribaric's method. In certain cases all three methods are known to give exact results for the critical Laplacian. In general, however, the Method of Optimized Parameters is the only one for which the sign of the error in the critical Laplacian is known. It has also previously been shown to compare very favorably with a finite difference equation solution. The discrepancies between the Standard, Optimized Parameter and Ribaric's method are discussed. The last two methods give results in fair agreement in most cases and are significantly different from results obtained by the Standard method in certain cases. The Method of Optimized Parameters has three advantages over Ribaric's method: the sign of the error in the critical Laplacian is known; it is easier to use than Ribaric's method for calculations; and it is more adaptable to reactors of complex shape. (auth)

16107 KY-294
Union Carbide Nuclear Co. Paducah Plant, Ky.
A GENERALIZED AND CONSISTENT METHOD FOR CALCULATING THE CRITICAL MASS OF HOMOGENEOUS AQUEOUS URANYL FLUORIDE SOLUTIONS. O. W. Hermann. June 8, 1959. 22p. Contract W-7405-eng-26. $0.75(OTS).

A more encompassing, yet consistent and practical, method of calculating the critical mass of aqueous uranyl fluoride solutions was developed. Comparison of calculated results with experimentation gave a maximum of only 2.3% error in the effective multiplication factor and 9% error in the critical mass, with absolute averages of 0.7% and 3.4%, respectively, through the ranges from high moderation down to an H/U of 25 for 90% U^{235} assays or an H/U of 4 for 2% U^{235} assays. (auth)

16108 MSD-1721
Lockheed Aircraft Corp. Missile Systems Div., Van Nuys, Calif.
A PROPOSED CRITICAL ASSEMBLY FACILITY IN PALO ALTO, CALIFORNIA. May 11, 1956. 58p. $9.30(ph), $3.60(mf) OTS.

A proposal is made to include as a part of a permanent research laboratory a critical assembly facility for studies of nuclear reactor cores. Sufficient information is included for the evaluation, building permit, and license applications. Descriptions are given of the site, physical plant, apparatus, and operating procedure. Work that is presently foreseen and estimates of associated hazards are also included. (A.C.)

16109 MSD-2001
Lockheed Aircraft Corp. Missile Systems Div., Van Nuys, Calif.
CRITICAL ASSEMBLY LMSD-2. Sept. 12, 1956. 42p. $7.80(ph), $3.30(mf) OTS.

The technical details and hazard analyses contained in MSD-1721 are amplified. A more detailed description of certain equipment, procedures, and calculations is given. The critical assembly will consist of a homogeneous right cylinder 12 in. in radius and approximately 24 in. high. The cylinder will be constructed of semicircular alloy plates of Be–U alloy. The alloy will contain approximately 7.1 wt. % of fully enriched U. (A.C.)

16110 MSD-2002

Lockheed Aircraft Corp. Missile Systems Div., Van Nuys, Calif.

CRITICAL ASSEMBLY LMSD-1. Sept. 12, 1956. 16p. $3.30(ph), $2.40(mf) OTS.

Lockheed Missile Systems Division proposes to erect and operate a privately owned critical assembly facility at its research center in Palo Alto, California. The LMSD-1, the first critical foil and moderator assembly to be constructed in the facility, is described, and the associated operations and hazards are discussed. (A.C.)

GEOLOGY AND MINERALOGY

16111 JEN-43

Spain. Junta de Energia Nuclear, Madrid.

ESTUDIO SOBRE LA CLASIFICACIÓN DEL MINERAL DE VENTA DE CARDEÑA. (Study on the Classification of the Uranium Mineral of Venta de Cardeña.) A. Rodrigo Otero. 1959. 78p.

The behavior of uranium mineral from Venta de Cardena in a spiral classifier which operates in a closed system with a ball mill was studied to obtain data for the design of a milling–classification system with a production capacity of 200 tons per day with a particle size less than 0.417 mm. The characteristics of such a system, the problems in normal operation, the inconveniences which these cause, and their solution were investigated. Correlations between these tests and the results obtained with long glass tubes are presented. (J.S.R.)

16112

MINERALOGICAL APPLICATIONS OF ELECTRON DIFFRACTION. II. STUDIES OF SOME VANADIUM MINERALS OF THE COLORADO PLATEAU. Malcolm Ross (U. S. Geological Survey, Washington, D. C.). Am. Mineralogist 44, 322-41(1959) Mar.-Apr.

A method of obtaining precise unit-cell data from oriented electron diffraction powder patterns is described. Partial unit-cell data obtained from such patterns and a description of the crystal habit are given for the following minerals: hewettite ($CaV_6O_{16} \cdot 9H_2O$), barnesite ($Na_2V_6O_{16} \cdot 3H_2O$), a new hydrated calcium vanadyl vanadate, corvusite ($V_2O_4 \cdot 6V_2O_5 \cdot nH_2O$), a "corvusite-like" mineral ($V_2O_4 \cdot 5V_2O_5 \cdot xH_2O$), fernandínite ($CaO \cdot V_2O_4 \cdot 5V_2O_5 \cdot 14H_2O$), navajoite ($V_2O_5 \cdot 3H_2O$), a "corvusite-like" mineral associated with navajoite, steigerite ($Al_2O_3 \cdot V_2O_5 \cdot 6\frac{1}{2}H_2O$), fervanite ($Fe_4V_4O_{16} \cdot 5H_2O$), and simplotite ($CaV_4O_9 \cdot 5H_2O$). For many of these minerals the unit-cell data are new. Structural relations between several of these minerals are indicated. (auth)

16113

NEUTRON RADIATION OF MINERALS AND THE FORMATION OF Ne^{21} IN THE EARTH'S ATMOSPHERE. L. L. Kashkarov and V. V. Cherdyntsev. Geokhimiya No. 7, 632-41(1958).

The neutron emission from uranium minerals, thorium minerals, and mixtures of the minerals with beryl, fluorite, Al_2O_3, MgO, SiO_2, and $BaSO_4$ were studied, and the results were tabulated. The mean neutron yield from ferrithorites is 0.9 to 0.2 neutrons/10^6 alpha particles. About 40% of the neutrons from uranium minerals originate from spontaneous fission and the remaining neutrons from $O^{18}(\alpha,n)Ne^{21}$ reactions. In ferrithorites the neutrons are produced in the $F^{19}(\alpha,n)Na^{22}$ reaction. At least one fourth of the Ne^{21} of the earth's atmosphere is formed by the (α,n) reaction in the earth's crust. (J.S.R.)

16114

CONCERNING THE CONTENT OF RADIOACTIVE ELEMENTS FOUND IN WATERS OF OIL FIELD DEPOSITS. F. A. Alekseyev, V. I. Yermakov, and V. I. Filonov. Geokhimiya No. 7, 642-9(1958).

The radium and uranium content of waters in oil field deposits was determined. Well and surface waters from West Turkmenia, Emba, and the Cis-Uralian region were investigated. Independent of the type of deposit, the radium content is seldom less than 10^{-11} g/l and the uranium content greater than 1.0×10^{-7} g/l. The largest quantities of radium are found in calcium chloride water, and the uranium is concentrated in sodium bicarbonate water. The marginal zones of oil field deposits have the largest amounts of radium. (J.S.R.)

16115

THE DISTRIBUTION OF URANIUM IN THE MINERALS OF CALEDONIAN GRANITOIDS OF THE SUSAMYR BATHOLITH. L. L. Leonova and L. V. Tauson. Geokhimiya No. 7, 650-9(1958).

The uranium content of the Susamyr batholith was determined in various intrusion phases. The mineral compound was measured in a large thin section. Uranium was found in every mineral with about 40 to 50% in the rock forming minerals and 50 to 60% in the accessory minerals. It was shown that uranium is probably contained in quartz and feldspar in the intercrystal spaces. Of the accessory minerals, zircon and orthite were especially rich in uranium. (J.S.R.)

16116

BOROMETRIC PROFILING BY THE NEUTRON METHOD. V. I. Baranov and V. K. Khristianov. Geokhimiya No. 7, 680-1(1958).

A method for the determination of the boron content of soils is described. A neutron source with an intensity of 1×10^7 n/sec is under a water reflector and connected to a neutron detector and recorder. The apparatus is moved along the surface at a speed of 4 to 5 km/hr. From the measured neutron absorption, 0.01% of B_2O_3 can be determined at a depth up to 10 to 15 cm. An example of the profiles obtained is given. (J.S.R.)

16117

PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER–13 SEPTEMBER 1958. VOLUME 2. SURVEY OF RAW MATERIAL RESOURCES. Geneva, United Nations, 1958. 852p. $18.50.

This volume, containing over 100 papers assigned to sessions on raw material supplies, geochemistry, mineralogy, geology, and prospecting, presents a comprehensive survey of the activities relating to nuclear raw materials. The distinguishing feature of this volume is the extensive research reported on the geological aspects relating to the known deposits of the ores. The latest data on ore reserves and the methods for prospecting are also reported. (J.E.D.)

HEALTH AND SAFETY

16118 AERE-HP/M-137

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A NOTE ON THE MAXIMUM PERMISSIBLE LEVELS

OF TRITIUM. R. M. Fry. Dec. 1958. 11p.

The various physical and biological parameters necessary to calculate the maximum permissible levels for tritium are reviewed. The values assumed in 1955 are compared with those recommended, which are calculated with total body as the critical organ. (C.H.)

16119 AERE-HP/R-2742
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
ENVIRONMENTAL SURVEY AROUND AN ATOMIC ENERGY SITE. G. H. Palmer. Dec. 1958. 33p.

Ground and aerial surveys were carried out around the Harwell establishment in order to assess the γ-ray activity present as a natural background. An assessment is made of the survey requirements in the event of a major incident. The discussion is limited mainly to the hazards associated with the deposition of I^{131}. (W.L.H.)

16120 ANL-6021
Argonne National Lab., Lemont, Ill.
COMMENTS OF THE HANDLING OF PLUTONIUM. M. J. Steindler. June 1959. 27p. Contract W-31-109-eng-38. $0.75(OTS).

Many of the features of plutonium facilities have been covered, and a number of them have been omitted. A great variety of safety equipment is available, together with trained personnel to operate it. All of these devices, however, do not assure a contamination-free operation. Basically, the careful design of enclosures, experimental equipment, and procedures when handled by trained personnel represents the only approach to the problem of plutonium handling. (auth)

16121 CWLR-2272
Chemical Warfare Labs., Army Chemical Center, Md.
SURVIVAL IN FALLOUT AREAS. [Period covered] January 1958—June 1958. Harold E. Shaw. Sept. 16, 1958. 39p. Project No. 4-12-10-007.

The individual soldier and small unit commander must have a better understanding of the fundamental characteristics of radiological fall-out. Such understanding is essential to the successful prosecution of any combat mission during a period of nuclear warfare. Knowledge of the formation, composition, and properties of fall-out, and an acquaintanceship with the biological effect of the radiations emitted by this fall-out, will guide the individual in his actions. Personal hygiene and shielding from the radiation are perhaps the most effective countermeasures against fall-out contamination available to the individual. The shielding afforded by field fortifications or other available protective configurations will reduce considerably the effects on the body of gamma irradiation; rigid hygiene will protect the individual from surface and internal effects of beta particles. Through participation in nuclear events and subsequent evaluation of the data obtained, much information has been obtained on radioactive fall-out, and several rules of thumb have been developed to assist the individual in a rapid estimation of this hazard. While these data are available in weapons test and other scientific reports, the information is in a form not readily amenable to general use. This report attempts to summarize, amplify, and clarify the current information available, and to present it in such form that it can be readily applied by doctrinal agencies. (auth)

16122 DANATOM-08-59
Danish Assn. for Industrial Development of Atomic Energy, Hellerup.
ON THE DETERMINATION OF PERMISSIBLE DOSE RATES IN NUCLEAR SHIPS. May 1959. 26p.

Permissible radiation dose rates were determined for persons on board and in the vicinity of a nuclear-powered ship. A method is set out for determining the permissible dose rates in the various locations. The importance of the subject in relation to expected international legislation in this field is discussed. (C.H.)

16123 ERDL-1569-TR
Engineer Research and Development Labs., Fort Belvoir, Va.
SOLUBILITY CHARACTERISTICS OF RADIOACTIVE BOMB DEBRIS IN WATER AND EVALUATION OF SELECTED DECONTAMINATION PROCEDURES.
Harry N. Lowe, Jr., Don C. Lindsten, Paul B. Pruett, William J. Lacy, and Joseph P. Kennedy. Feb. 12, 1959. 87p. Project No. 8-75-07-460. (AD-212440).

Radioactive debris resulting from a normal nuclear detonation is only sparingly soluble in water in the pH range of natural surface waters. Where effective clarification procedures are used, only the dissolved radioactive contaminants will be of importance to those charged with responsibility for the safety of potable water systems. To accomplish complete decontamination, normal water-treating (clarification) processes must be supplemented by distillation, ion exchange, or other processes which remove essentially all dissolved solids from water. (auth)

16124 KAPL-2031
Knolls Atomic Power Lab., Schenectady, N. Y.
SEMIANNUAL PROGRESS REPORT OF RADIOLOGICAL DEVELOPMENT ACTIVITIES IN HEALTH PHYSICS FOR JULY—DECEMBER 1957. R. J. Feinberg, comp. 27p. Contract W-31-109-Eng-52. $1.00(OTS).

Improvements were made in the determination of the collection efficiencies of the Unijet Freon portable air sampler for I^{131}. The aluminum beta-gamma personnel dosimeters were placed in field use and tested over a three-month period. Each beta dosimeter was worn with a gamma-sensitive pocket ionization chamber. The daily exposures were recorded and supplemented by film badge readings integrated over a two-week interval. The results indicate that the aluminum beta-gamma dosimeters as beta detectors are as reliable as the currently used commercial (gamma) pocket dosimeters for measuring daily gamma exposures. Modifications were made in the assembly of the Universal Pocket Dosimeter to eliminate leakage. A preliminary study was made of its beta energy dependence in which several flat beta sources were used. The magnitude of latent image fading effects for the sensitive x ray film was made for a range of integrated gamma doses. The KAPL water-moderated sigma pile substitute was calibrated for thermal neutrons. It uses Ra-Be and Pu-Be sources. A comparison was made of the levels of radioactivity detected in Mohawk River fish as the levels vary with season or sewage—river-water temperature. To attain data for toxicity evaluations, a metal cage was designed and placed with specimens of carp, bullheads, and sunfish near the Knolls Site sewer outlet. A buoy-anchor mechanism facilitated the moving of the cage to various depths and locations in the river. The results of this study showed the temperature and density effects on the dispersion of the sewage. Chemical determinations of the Sr/Ca ratios in Mohawk River water and aquatic life were made to determine potential hazards to populations relative to Sr/Ca intake. Improvements in the area of reactor safeguards concerned the inclusion of the build-up factors into the fission product cloud dose formula and resulted in the use of correction factors in the evaluation of power reactor incidents. (For preceding period see KAPL-1964.) (auth)

16125 NP-7640
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
MEASUREMENTS OF RADIOACTIVE FALL-OUT AND AEROSOLS IN WARSAW, POLAND, DURING THE YEAR 1958. Report No. 68/X doz. R. Szepke, Z. Gorberg, and T. Deszczak. Feb. 1959. 28p.

Methods are described for collecting, preparing, and counting samples of fall-out, rain water, and aerosols. Results of measurements made during 1958 are compared with maximum permissible levels. The dates of test explosions are assigned from the decay of activity in samples collected in Poland. (C.H.)

16126 NYO-4810
Harvard Univ., Boston. Air Cleaning Lab.
AIR CLEANING STUDIES. Progress Report for July 1, 1956 to June 30, 1957. Richard Dennis, Leslie Silverman, Edward Kristal, Felix Stein, and Philip Drinker. June 30, 1959. 52p. Contract AT(30-1)-841. $9.30 (ph), $3.60(mf) OTS.

Progress is reported on the air and gas cleaning project conducted by Harvard University for the Division of Reactor Development of the U.S. Atomic Energy Commission. Design modifications in a commercial automatic sampler to convert it for use as a continuous stack monitor are described. Studies on electrostatic mechanisms in particulate collection were centered on an experimental device consisting of fluidized plastic granules. Evaluation of commercial dust collection apparatus included tests on a device having an electric field superimposed on fiber matting, a new type wet collector, and a high velocity cyclone. Progress is reported in studies on the design of gas cleaning equipment for an institutional type incinerator, investigation of iodine and carbon floc removal from high-temperature gas streams, an economic survey of gas cleaning costs within the AEC, the development of filter equipment to collect NaK fume, and preparation of apparatus for a field study on blast effects on air cleaning systems. Publications during the period are listed, and consulting and training activities during the period are summarized. (For preceding period see NYO-4809.) (C.H.)

16127 SC-3887(TR)(Del.)
Sandia Corp., Albuquerque, N. Mex.
THE INFLUENCE OF ERRORS IN WINDS ON THE DETERMINATION OF IMMEDIATE FALLOUT ACTIVITY. C. E. Buell. Nov. 1956. Decl. with deletions May 20, 1959. 64p. $10.80(ph), $3.90(mf) OTS.

The first part of this report compiles wind statistics, describing quantitatively the variability of the natural wind structure insofar as it affects the fall-out of radioactive particles. The data pertain to the wind variability from the climatological mean, from short-term persistence, and from skilled meteorological forecasts. Next, a very simple fall-out model is derived, roughly approximating the observed patterns as dependent on wind. Finally, the measures of wind variability are applied to this fall-out pattern to obtain some estimates of the effect of wind variability on the forecast fall-out pattern. It is found that the wind variability is so large that great refinement in the fall-out model details cannot possibly lead to a great improvement in fall-out forecasting. (auth)

16128 SCTM-152-55-51
Sandia Corp., Albuquerque, N. Mex.
A METHOD OF COMPUTING FALLOUT EFFECT. J. D. Hankins and J. W. Weihe. Aug. 22, 1955. Decl. May 20, 1959. 17p. Contract [AT(29-1)-789]. $3.30 (ph), $2.40(mf) OTS.

The maximum chronic radiation dose resulting from the fall-out contamination due to a multiple strike is expressed as a relatively simple function of location. The method leading to the construction of such a function, the assumptions which are made, and an application of the procedure are given. Although wind shear is not considered, random variation about a mean wind can be handled by this method. (auth)

16129 SCTM-182-54(51)
Sandia Corp., Albuquerque, N. Mex.
NOTES ON RAINOUT FROM ATOMIC DETONATIONS. C. E. Buell. Aug. 2, 1954. Decl. May 20, 1959. 38p. Contract [AT(29-1)-789]. $6.30(ph), $3.00(mf) OTS.

An expression is developed for probability of rainout from an atomic cloud exceeding an acceptable infinity dose. Calculations are made on the basis of known climatological data for several locations in the United States. It is found that, although rainout of active material for low-yield (2-kt) weapons may be significant, the probability of this rainout resulting in an infinity dose of more than 100 r is of the order of only a few percent, or less, depending largely on the altitude at which the detonation occurs and the climate of the region concerned. (auth)

16130 TID-4000(4th Ed.)
Technical Information Service Extension, AEC.
AVAILABILITY LISTING OF REPORTS ABSTRACTED IN NUCLEAR SCIENCE ABSTRACTS. June 1959. 492p. $5.00(OTS).

A listing in alpha-numeric order of all reports which were abstracted in Nuclear Science Abstract (NSA), Vols. 1 through 12, and the two volumes of Abstracts of Declassified Documents (ADD) which preceded NSA is presented. The report number, the corresponding NSA or ADD volume and abstract number, and a brief notation regarding the latest known availability are given. Prices and types of copy available are also included. (J.R.D.)

16131 TID-5551
Division of Biology and Medicine. Radiation Effects of Weapons Branch, AEC.
FALLOUT FROM NUCLEAR TESTS AT THE NEVADA TEST SITE. Gordon M. Dunning. May 1959. 95p. $1.00(OTS).

Presented at the Hearings on Fallout before the Joint Committee on Atomic Energy, May 5-8, 1959.

About one megaton of energy from fission has been released at the Nevada Test Site from nuclear test detonations. The total resultant fission product activity, if measured at one hour after formation, would have been about 400 to 600 billion curies. There was nothing that could be done to lessen the production of radioactive isotopes from a fission reaction, thus the utmost care and skill were required in the conduct of the tests to minimize the deposition of the activity outside the Test Site. A summary of the data on fall-out from nuclear detonations at the Nevada Test Site is presented. (auth)

16132 TID-5554
Division of Biology and Medicine, AEC.
SUMMARY OF NEW DATA ON ATMOSPHERIC FALL-OUT. Joshua Z. Holland. May 1959. 15p. $0.50 (OTS).

Presented at the Hearings on Fallout Before the Joint Committee on Atomic Energy, May 5-8, 1959.

Data are presented on the concentration of strontium-90 in samples of soil, rain water, and surface and stratospheric atmosphere collected throughout the world during 1958 and 1959. Data are included on the concentration of strontium-89 in samples of rain water. Data indicate that the fall-out has not been coming down at a uniform rate. Maximum levels of strontium-90 contamination of soil were demonstrated in the zone 40 to 50° north. The average value of about 33 millicuries of strontium-90 per square mile is compared with a value of 17 in 1956. (C.H.)

16133 TID-7019
Oak Ridge Gaseous Diffusion Plant, Tenn.
GUIDE TO SHIPMENT OF U-235 ENRICHED URANIUM MATERIALS. H. F. Henry, comp. and ed. June 1959. 82p. $1.00(OTS).

Basic criteria applicable to the shipment of U materials enriched in U^{235} isotope are presented. The manual is presented as a guide rather than a source of answers to specific problems and is concerned only with nuclear safety aspects. General provisions are given including definitions, followed by basic nuclear safety requirements, and a discussion of shipping containers. Also, included are various container system drawings as well as nuclear safety data. (J.R.D.)

16134 AERE-Lib/Trans-790
THE RADIOACTIVITY IN THE RISÖ DISTRICT. MEASUREMENTS UP TO APRIL 1, 1957. (Radioaktiviteten i Risö Omradet. Malinger indtil April 1, 1957.) K. Heydorn, J. Lippert, and P. Theodorsson. Translated by M. K. Rundo (U.K.A.E.A. Atomic Energy Research Establishment) from report RISÖ-1 (NP-6672), June 1957. 164p.

In 1955 the Danish Atomic Energy Commission decided that a research station comprising one or more reactors with attached laboratories should be built on the Risø penisula in Roskilde fjord about 30 km west of Copenhagen. Preliminary measurements were made of the radioactivity in samples of surface water, sea water, soil, fish, vegetation, drinking water, and milk collected in the district. (C.H.)

16135 JPRS-453-D
TECHNOLOGY OF SAFETY AND LABOR PROTECTION IN WORK WITH RADIOACTIVE ISOTOPES. Translated from Vrachebnoe Delo, 329-32(1957). 4p. $0.50(OTS).

The status of radiation protection procedures in laboratories and agencies engaged in work involving the use of radioisotopes is discussed. (C.H.)

16136 JPRS(NY)-L-475
EXCERPTS FROM "ATOMIC WEAPONS AND ANTI-ATOMIC DEFENSE." (Translated from Russian). 116p. $2.50(OTS).

Factors affecting the radioactive contamination of an area during atomic explosions are discussed. Procedures and equipment for the protection of armies during radiological warfare are described. Design features of shelters are described and illustrated. Radiation detection instruments which may be used as monitors and dosimeters are described. Means of insuring the operation of troops in a locally contaminated area are described. 55 figures. (C.H.)

16137 JPRS-tr-L-577-N
THE QUESTION OF RADIOACTIVE POTASSIUM CONTENT IN URBAN SEWAGE. L. B. Doliva-Dobrovol'skaya and F. S. Zavel'skii (Zavel'skiy). Translated from Med. Radiol. 3, No. 3, 65-7(1958). 6p. $0.50 (OTS).

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 13692.

16138 NP-tr-249
ON THE QUESTION OF THE EFFECT OF BERYLLIUM FLUORIDE ON AN ORGANISM. E. M. Zamakhovskaya (Zamakhovskaia), B. I. Martsinkovskii, and E. E. Syroechkovskii. Translated by Morris D. Friedman (Lincoln Lab., MIT) from Gigiena Truda i Tekh. Bezopasnosti, No. 2, 23-32(1934). 15p. $3.30(ph), $2.40(mf) JCL or LC.

Hazards associated with the production of beryllium metal are discussed. A process is outlined which involves the production of beryllium salts by a fluosilicate method and electrolysis of these salts to produce metallic beryllium. Procedures are outlined for insuring safety in beryllium production plants. (C.H.)

16139
CERTAIN PROBLEMS OF RADIATION SAFETY ON THE ATOMIC ICE-BREAKER "LENIN." A. I. Burnazyan, I. D. Kamyshenko, and Yu. G. Nefedov. Med. Radiol. 4, No. 4, 70-2(1959) Apr. (In Russian)

Measures necessary for fulfilling health physics requirements in operation of the atomic ice-breaker "Lenin" are described. (T.R.H.)

16140
THE PRDC CASE. James L. Morrisson (Ginsburg, Leventhal, Brown and Morrisson, Washington, D. C.) and B. John Garrick (Holmes and Narver, Inc., Los Angeles). Nucleonics 17, No. 7, 60-3(1959) July.

Litigation of the PRDC case is reviewed. A construction permit for the PRDC Reactor was requested by the Power Reactor Development Company. A provisional construction permit was issued by AEC. Three labor unions filed petitions to intervene in the licensing proceeding and requested a hearing. The hearing demonstrated that reactor safety issues can be handled by traditional administrative processes. (A.C.)

16141
IMPROVEMENTS IN SHIELDS FOR PROTECTION AGAINST NEUTRONS. Jean Duchêne (to Commissariat à l'Énergie Atomique). British Patent 816,235. July 8, 1959.

A flexible shielding material and its preparation are described. Boron carbide powder is mixed with a polyvinyl chloride resin dissolved in a suitable solvent. The solvent is evaporated and the mixture cast in a mold shaped like a glove, suit, or other shape for protection of a worker. Heating at 150°C for 1 hr solidifies the material. (T.R.H.)

INSTRUMENTS

16142 AERE-R-2902
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
GENERAL PURPOSE PRINTED WIRE COMPONENT

BOARDS FOR USE WITH TRANSISTOR CIRCUITS. J. G. Page. Apr. 1959. 28p. $0.98(BIS).

Several printed circuit component boards for general purpose use with transistor circuits were produced. These save time and labor in many stages of design and production and between them appear to be suitable for the great majority of low voltage transistor circuits at present in use. (auth)

16143 AFSWC-TR-57-40
Air Force Special Weapons Center, Kirtland AFB, N. Mex.
EVALUATION OF PORTABLE ALPHA SURVEY INSTRUMENTS. Richard F. Merian and John B. O'Loughlin. Dec. 1957. 29p. Project No. 7801.

The Air Force standardized alpha survey meter, AN/PDR-10, and six other commercially available alpha survey meters were field tested to determine their suitability for Air Force use in the monitoring of large-area plutonium contamination. The AN/PDR-10 was found to be completely unsatisfactory for field use. The other meters tested were unsatisfactory for Air Force standardization to field usage. The Eberline Instrument Model PAG-2G is recommended for use by the Air Force as an interim instrument for alpha monitoring. A scintillation-type alpha survey instrument should be designed and developed according to specifications determined as a result of these tests, and field tested for possible adoption by the Air Force as a standardized alpha survey instrument. (auth)

16144 APEX-501
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
A HIGH IMPEDANCE INPUT CIRCUIT USING GERMANIUM TRANSISTORS. J. J. Baum. Sept. 1958. 19p. Contracts AF33(600)-38062 and AT(11-1)-171. $0.75 (OTS).

A bootstrapped-emitter-follower circuit that achieves an input impedance greater than 10^7 ohms with germanium transistors is described. The circuit is analyzed and compared with a single emitter follower and a super-alpha-connected emitter follower for input impedance characteristics. (auth)

16145 CERN-59-20
European Organization for Nuclear Research, Geneva.
SOME OF THE EXPANSION MECHANISMS CONSIDERED FOR LIQUID HYDROGEN BUBBLE CHAMBERS. P. Amiot, G. Nullens, and R. Spöndlin. Apr. 29, 1959. 22p.

Experience with bubble chambers is confined to small chambers. Several laboratories are designing, constructing, and testing large chambers with a volume of several hundred liters. One of the basic problems of bubble chambers is that of expansion mechanisms. An investigation of the problems connected with cold gas expansion and purely liquid expansion through fluid circulation was made. In both cases estimates are based on a 2 × 0.6 × 0.50 m chamber with a volume of the order of 540 liters. The question of the speeds of expansion and recompression is briefly discussed. (A.C.)

16146 DANATOM-04-59
Danish Assn. for Industrial Development of Atomic Energy, Hellerup.
KOMPONENT-PÅLIDELIGHED OG KOMPONENTFEJL I ELEKTRONISK UDSTYR. (Component Dependability and Failures in Electronic Equipment.) Egon Hansen. Mar. 1959. 48p.

The results of a literature search on component dependability are summarized, and the reliability and failures are analyzed. Techniques for measurement of the dependability were developed, and the basic laws governing the component dependability were determined. Electron tubes, semiconductors, condensers, resistors, and relays were considered. 67 references. (J.S.R.)

16147 DP-361
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.
AN IN-LINE CONDUCTIVITY METER WITH TEMPERATURE COMPENSATION. Donald W. Colvin. Apr. 1959. 12p. Contract AT(07-2)-1. $0.50(OTS).

An in-line conductivity meter is described which was used to measure the nitric acid concentration of a process stream in the range from 0.1 to 0.4 molar with an error less than 0.03 molar. The instrument automatically compensated for the conductivity changes caused by temperature variations of the solution over a range from 20 to 50°C. (auth)

16148 HW-58302(Rev.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
A FILAMENT FURNACE FOR HIGH TEMPERATURE MICROSCOPY. H. W. Newkirk, Jr. and J. L. Bates. Apr. 2, 1959. 14p. Contract W-31-109-eng-52. $0.50(OTS).

A filament furnace is described which is suitable for heating gram quantities of materials at temperatures up to 3000°C under reduced pressures or in various atmospheres. A quartz window and shutter assembly permit the observation of the specimen by long working distance microscopes during the heating cycle. (auth)

16149 IGO-R/W-70
United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.
A REMOTELY CONTROLLED SHIELDED EVAPORATOR FOR LABORATORY USE. A. J. Howarth. [Nov. 14, 1958]. 10p. $0.25(BIS).

An evaporator is described for the concentration of, and removal of chloride from, waste liquors arising from the analysis of high activity samples. The entire unit may be assembled, operated and disassembled remotely and requires no attention other than the removal of its product. Nitric acid is also removed from active liquors during the process. The possible use of the unit for evaporation of highly active plant waste solutions is considered. (auth)

16150 IGO-TM/CA-015
United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.
A FLEXIBLE POLYTHENE GLOVE BOX. A. Hughes. Nov. 1957. 8p.

The need for a glove box capable of maintaining an inert atmosphere arose during the sampling and analysis of the alkali metals. The conventional rigid glove box was found to be unsuitable in practice and also inefficient in theory. The requirement was met by improvising a flexible glove box from thin polythene sheet. The alternative solution to this problem would have required an expensive vacuum glove box with its attendant pumping unit. (auth)

16151 KAC-58-92-PR-1
Kaman Aircraft Corp., Bloomfield, Conn.
DEVELOPMENT AND FABRICATION OF NON-

DESTRUCTIVE SPECIFIC GRAVITY MEASURING EQUIPMENT EMPLOYING RADIATION TECHNIQUE. Monthly Progress Report for January 1958. 33p. ORD Project No. TA2-8051. (AD-161550).

A detailed design description of a high-accuracy densitometer using gamma radiation is presented. It is noted that the designers feel confident of success and have proceeded with development of sources for the various components. The status of procurement is described as well as progress in system analyses such as determination of the scaler ratio requirements, analysis of scintillation detectors, shielding analysis, servosystem requirements determination, and others. (J.R.D.)

16152 NML-5115-9.6
New York Naval Shipyard. Material Lab., Brooklyn.
RADIAC GROUP AN/UDA-1 ( ) ISOTOPES SPECIALTIES CO., INC.: EVALUATION OF PROBLEM No. 1103-9.6. Final Report. [1958]. 11p. (AD-159365).

A group of radiac accessories which may be used in the determination of the concentration of radioactivity in solution or other media was evaluated. Included are calibration data for P-32 and Co-60 as well as measurements on Co-60 samples. The radiac group did not meet requirements, and a list of deficiencies is presented. (J.R.D.)

16153 NP-7576
[Army Signal Research and Development Lab.] Exploratory Research Div. S, Belmar, N. J.
GODIVA II IRRADIATION OF SEMIRAD, OCTOBER 9 AND 10, 1958. Stanley Kronenberg and Harry M. Murphy, Jr. Dec. 17, 1958. 20p.

Results of an experiment are reported in which SEMIRAD were exposed to the burst neutron radiation from the LASL Godiva II Reactor. The object of the experiment was to test the capabilities of SEMIRAD for measurement of ultrahigh radiation intensities with short resolving times at the highest possible neutron radiation dose rates obtainable under laboratory conditions, and to measure the relative spread in time of the neutron delivery rate due to time-of-flight scattering effects at a distance corresponding to approximately one-third mean free path from Godiva II. (W.D.M.)

16154 NP-7577
[Army Signal Research and Development Lab.] Exploratory Research Div. S, Belmar, N. J.
EVALUATION OF SEMIRAD FOR DOSE-RATE-INDEPENDENT MEASUREMENT OF FAST-NEUTRON AND GAMMA RADIATIONS. Stanley Kronenberg and Harry M. Murphy, Jr. Oct. 10, 1958. 40p.

The principles of secondary-electron mixed-radiation dosimeter (SEMIRAD) operation are described. Results of experiments performed at USASRDL, LASL Godiva II facility, and the Naval Research Laboratory are discussed. In general construction, SEMIRAD have the same appearance as ion chambers. However, instead of being filled with air or gas, SEMIRAD are evacuated to very low pressures. As a consequence, little or no ionization is produced, and the entire response is due to secondary electron production which makes SEMIRAD dose-rate independent. A preliminary evaluation of SEMIRAD based on theoretical computation and experiments conducted to date is made. (W.D.M.)

16155 RL-230
General Electric Co. Research Lab., Schenectady, N. Y.
A HIGH TEMPERATURE MICROSCOPE FOR METALLURGICAL STUDIES. A. L. Williams. June 1949. 11p.

A microscope attachment was designed and constructed specifically for the study of metallurgical samples at high temperatures. A sample is mounted and heated by resistance in a chamber which can be evacuated or opened to a particular atmosphere. The sample is viewed through a quartz window at a maximum magnification of 150X. Phase changes and grain growth have been observed in the temperature region from room temperature to 1000°C. (auth)

16156 SC-4229(TR)
Sandia Corp., Albuquerque, N. Mex.
DESIGN CHARACTERISTICS AND PERFORMANCE OF SANDIA'S DEACON-ARROW CHAFF-ROCKET SYSTEM. C. T. Force and W. E. Walker. Nov. 1958. 52p. Contract [AT(29-1)-789]. $1.50(OTS).

A system which is capable of dispensing chaff at any desired altitude from sea level to 380,000 feet was designed and developed. The system is described and its capabilities are presented. (auth)

16157 SCDC-878
General Mills, Inc., Minneapolis.
SUMMARY REPORT ON MOBILE REMOTE HANDLER. Report No. 1799. R. S. Karinen, J. K. Figenshau, G. R. Rose, and P. Hyrcak. Nov. 20, 1957. 59p. For Sandia Corp. $9.30(ph), $3.60(mf) OTS.

A description is presented of a Mobile Remote Handler which will permit an operator to carry out the following: to move safely and freely about in a radiation area where gamma radiation may greatly exceed biological tolerances and to perform various remote operations on equipment or tools in the radiation area. This device will be mobile, will provide means of remote operation, and will completely enclose the operator in a protective radiation shield. (W.L.H.)

16158 SCTM-257-55(54)
Sandia Corp., Albuquerque, N. Mex.
EVALUATION OF THE TNA-9 AND TNA-10 "TUNABLE SLOT ANTENNAS." A. L. McMullen. Dec. 13, 1955. 25p. Includes Appendix 1: FM/FM TELEMETERING TRANSMITTING COMPONENT DATA. Dec. 28, 1954. Contract [AT(29-1)-789]. $4.80(ph), $2.70(mf) OTS.

An evaluation is given of the Bendix Aviation Corporation's tunable slot antennas, models TNA-9 and TNA-10. These antennas were specifically designed as FM/FM telemetering components, tunable within the 215 through 235 Mcs band of frequencies. The models TNA-9 and TNA-10 are physically small slot antennas which obtain resonance by the use of lumped constants. Compared to a resonant $\lambda/2$ slot antenna, they are inefficient and narrow band antennas. The TNA-9 is a bidirectional slot antenna with a power handling capability rated as 5 watts. The TNA-10 is a unidirectional cavity-backed slot with a power handling capability rating of 150 watts. (auth)

16159 UCRL-3307(Rev.)
California. Univ., Berkeley. Lawrence Radiation Lab.
LAWRENCE RADIATION LABORATORY COUNTING HANDBOOK. Jan. 1, 1959. 224p. Contract W-7405-eng-48. $3.50(OTS).

A large number of nuclear counting devices are included with detailed descriptions and operating specifications. The listings are as follows: amplifiers, cables and coaxial components, coincidence systems and discriminators, components, definitions and standards, engineering performance and applications, oscilloscopes and monitoring, photomultipliers and scintillators, scalers and readout equipment, and wave-form generators and analyzers. (A.C.)

16160 USNRDL-TR-326
Naval Radiological Defense Lab., San Francisco.
AN ALPHA SURVEY RADIAC FOR FIELD USE.
K. Sinclair and G. Kiyoi. May 14, 1959. 34p.

An alpha survey radiac employing a photomultiplier tube and scintillation detector has been developed. The instrument utilizes transistor circuitry and operates from two standard flashlight batteries. Four linear ranges are provided with full scale indication on the highest range corresponding to 10,000 $\mu g/m^2 Pu^{239}$. The instrument was designed with a separable probe and a telescoping extension for easier ground monitoring. A thorium metal source is attached to the instrument housing for checking instrument calibration in the field. The device conforms satisfactorily to the military requirements for altitude, humidity, vibration, shock, and storage. The operational battery life is in excess of 40 hours. Instrument error at low temperatures slightly exceeds the ±20% accuracy requirement; however, adequate measurements are readily made by using the thorium check source to provide a check point. Instrument response to low energy x rays is excessive. However, tests indicate that a simple lead filter will eliminate this difficulty. (auth)

16161 WAPD-AD-TH-475
Westinghouse Electric Corp. Bettis Atomic Power Div., Pittsburgh.
EXPERIMENTAL AND THEORETICAL ANALYSIS OF THE TRANSIENT RESPONSE OF SURFACE BONDED THERMOCOUPLES. E. R. Quandt, Jr. and E. W. Fink. [Mar. 1959]. 44p. \$7.80(ph), \$3.30(mf) OTS.

Attached to this report is a letter (WAPD-AD-TH-476) containing pertinent data from S. J. Green dated March 3, 1959. 1p.

Analytical and experimental techniques which describe the transient response characteristics of thermocouples welded to the external surface of electrically-heated test sections were developed to more accurately measure temperatures during transient DNB and pressure drop experiments. Methods used in development work are described, and discussions of theory, experimental studies, and application to generalized transient heat transfer tests are presented. (J.R.D.)

16162 CEA-tr-A-408
UN APPAREIL POUR LES MESURES DE COINCIDENCES A GRAND POUVOIR DE RESOLUTION. (High Resolution Apparatus for Coincidence Measurements.) H. Bradt and P. Scherrer. Translated into French from Helv. Phys. Acta. 16, 251-8(1949). 14p.

A coincidence amplifier with a maximum resolution of 0.8×10^{-7} sec is described. The coincidence and anticoincidence circuits are given. The limitation of the useful resolution by the time lag is determined. (J.S.R.)

16163 CERN-59-19
INTERNATIONAL CONFERENCE ON INSTRUMENTS FOR THE EVALUATION OF PHOTOGRAPHS HELD AT CERN, GENEVA, ON FEBRUARY 23, 1959. Summary of Proceedings. (Conference Internationale Sur Las Instruments Pour L'Evaluation Des Photographies, Reunie Au Cern À Geneve 23 Fevrier 1959: Résumé.) Translated from report CERN-59-10, Mar. 11, 1959. 18p.

A conference was held at CERN to discuss the requirements of instruments for the evaluation of photographs and to explore the possibilities of joint action in future dealings with suppliers. A summary is given of the ideas and proposals of the meeting. (A.C.)

16164 JPRS-L-1533-D
WIDE-RANGE AMPLIFIER FOR AIR SHOWER DETECTOR. Amano, Miura, Oda, Kan, Tanahashi, Tanaka, and M. F. Crouch. Translated from Japanese report INS-TCA-9, Dec. 15, 1957. 18p. (Includes original, 11p.). \$0.50(OTS).

An amplifier with wide dynamic range for air-shower particle detectors was developed. The principle of operation, first developed at MIT, is the following: a single pulse is converted to four successive pulses with different effective gains, the gain of a pulse being one fifth of the succeeding pulse, utilizing two "delay-or-attenuation" networks. This series of pulses is amplified and is displayed on the oscilloscope. This procedure corresponds to having four amplifiers in order to cover a wide range of the input pulse height. (auth)

16165
MODIFIED SARGENT-MALMSTADT AUTOMATIC TITRATOR FOR REMOTE CONTROL USE WITH PLUTONIUM SOLUTIONS. Glenn R. Waterbury (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 31, 1138-41 (1959) July.

Several modifications to adapt the commercially available, differential-potentiometric automatic titrator for use with plutonium solutions and to improve parts of it for specific purposes include replacing the gravity-flow buret with a motor-driven syringe buret, replacing the stirrer with a magnetic stirrer, rewiring the titrator for remote operation inside a plutonium dry box or hood, and adding a microammeter to indicate potential changes. For trial titrations of cerium(IV) and chromium(VI) with iron(II), standard deviations of less than 0.01 relative % were obtained by using large samples and weight burets with the modified titrator. (auth)

16166
NON-DESTRUCTIVE TESTING WITH THE 31-Mev BETATRON OF BROWN-BOVERI. M. Sempert (AG. Brown, Boveri & Cie, Baden, Switzerland). Atomwirtschaft 4, 201-10(1959) May. (In German)

A 31-Mev betatron, which can inspect thicknesses from 50 to 500 mm with a very good defect sensitivity, is described. Characteristic possibilities of the betatron for material testing are discussed. Three fixed installations and a planned mobile unit are described. (auth)

16167
THE RESOLVING POWER OF A BETA SPECTROMETER USING A MAGNETIC FIELD WITH CONSTANT rH. Claude Bastard. Compt. rend. 248, 3295-7(1959) June 8. (In French)

A new type of β spectrograph is described which uses a magnetic field of revolution in a plane of symmetry such that the product rH is constant (r is the distance from a point in the plane of symmetry to the axis of revolution, and H is the field intensity at that point). The trajectories in the plane of symmetry corresponding to an injection angle perpendicular to the axis of revolution are trochoidal trajectories. Radial focusing is perfect; the precession has the value $\delta = 2\pi \times 1-[K/(K^2-1)^{1/2}]$ where $K = r_0H_0/pH$ (pH is particle momentum, r_0 the distance from source to axis revolution, and H_0 the field intensity in the plane of symmetry at r_0). Practical considerations lead to a value of 2.04 for K, r_0 = 20 cm., and an average direction of injection perpendicular to the circle $r = r_0$, the maximum projection angle being 45° either side of this direction. (T.R.H.)

16168

MONITORING RADIOISOTOPE TRACERS IN INDUSTRY. F. E. Armstrong and E. A. Pavelka (Bureau of Mines, Bartlesville, Okla.). Electronics 32, No. 26, 42-3(1959) June 26.

A radiation detection instrument (pulse type) is described for monitoring radioisotope tracers in industry. The instrument is portable and does not require skilled personnel for its operation. Although the instrument was designed specifically for use in the application of radioisotope tracers to petroleum production, it is adaptable to many other field problems which require continuous recording of similar information. (A.C.)

16169

PARTS PER MILLION ANALYSES BY IONIZATION DETECTOR. R. F. Wall (Monsanto Chemical Co., [St. Louis]). Ind. Eng. Chem. 51, 71A-2A(1959) June.

An ionization chamber trace analyzer offering sensitivities in the parts per billion range for many analyses and in the parts per million range for others is described. Ionization is provided by a radium or equivalent source. The analyzer uses two detector cells in parallel in a bridge arrangement to obtain maximum stability and independence of variation in sample background and environmental conditions. The analyzer has been used mostly in studies of atmospheric contaminants such as halogen acids, ammonia, nitrous oxide, sulfur dioxide, and others. Contaminants are measured by adding a reagent which produces smoke upon reaction with the contaminant. Development of systems to produce smokes or fogs specifically for trace contaminants of interest is in progress. (J.R.D.)

16170

IONIZATION CHAMBER FOR HIGH-TEMPERATURE GAS CHROMATOGRAPHY. L. H. Mason, H. J. Dutton, and L. R. Bair (U. S. Dept. of Agriculture, Peoria, Ill.). J. Chromatog. 2, 322-3(1959) May.

Construction of an ionization chamber from readily available materials is described which is applicable to high-temperature (240°C) gas chromatography. A diagram of the model based on the use of Teflon as the main insulator is presented as well as an illustration of results obtained with tritium labeled methyl stearate. (J.R.D.)

16171

SCINTILLATING SOUND ALPHA OF LARGE SURFACE. Josef Šilar and Jaroslav Smola. Jaderná energie 5, 124-8(1959). (In Czech.)

Experiments were made to examine the efficiency of photon transmission through a truncated Umaplex (Czechoslovak Plexiglass) light conductor and to measure dislocation of pulse heights on the outlet of the scintillating sound. The principal characteristics of the detector, e.g., plateau, background, and local detection efficiency, were measured on a prototype of the Czechoslovak photomultiplier 61 PK 411. (auth)

16172

A PHOTOMETER FOR FILM DOSIMETRY. Zd. Spurný and J. Kočí. Jaderná energie 5, 129(1959). (In Czech.).

A design is given for an apparatus for reading personnel film dosimeters. (R.V.J.)

16173

ELECTRONIC INSTRUMENTATION FOR NUCLEAR POWER PLANTS. C. W. Cawthorne. Nuclear Eng. 4, 263-5(1959) June.

Methods of producing the necessary signal for the transmission of information derived from conventional instruments used in monitoring a power reactor system are discussed in relation to measurement of pressure, temperatures, flow, level, density, and position. Several drawings of instruments are shown. (A.C.)

16174

RADIATION DETECTORS. 3. THEIR OPERATING LIMITATIONS. A. L. Gray (Plessey Nucleonics, Ltd.). Nuclear Power 4, No. 37, 103-5(1959) May.

All types of detectors are limited by their response to unwanted radiation. Detectors chosen must be of sufficient sensitivity to provide from the lowest level to be measured a statistical error small enough to be within the limits of accuracy required. The influence of these factors on the choice of a detector and the limits within which corrections may be applied for their effects are considered. Detector resolution is defined and discussed. Decay times of common phosphor materials and count-rate upper limit for common detector/amplifier combinations are tabulated. (A.C.)

16175

TRANSISTORIZATION. Fred S. Goulding (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Nucleonics 17, No. 6, 64-71(1959) June.

Transistor and semiconductor diodes, compared with vacuum tubes in nucleonic instruments, offer the advantages of increased reliability, smaller size, and cooler operation. These elements are already replacing tubes in all trigger and switching circuits in the field. Recently developed transistors open the way for transistorization of the remaining circuits basic to radiation detection systems. Problems of transistor-circuit design and semiconductors are discussed. (A.C.)

16176

DISCRIMINATORS. Kenneth A. McCollom (Phillips Petroleum Co., Idaho Falls, Idaho). Nucleonics 17, No. 6, 72-7(1959) June.

A pulse discriminator is a nonlinear circuit element with a discontinuity in its voltage-current characteristic at a threshold of current or voltage. A satisfactory pulse-height discriminator must have adequate frequency bandwidth, adequate resolution, and satisfactory dynamic overload characteristics. These design characteristics are discussed for several discriminators including transistor discriminators. (A.C.)

16177

SCALERS. Hugh F. Stoddart (Baird-Atomic, Inc., Cambridge, Mass.). Nucleonics 17, No. 6, 78-81 (1959) June.

The necessity of dividing or scaling-down the counting rate electronically to a level at which it can be measured is briefly discussed. The flip-flop circuit is described, and some theory on the statistics of counting is given. (A.C.)

16178

G-M COUNTERS. K. Van Duuren, A. J. M. Jaspers, and J. Hermsen (Philips' Research Lab., Amsterdam). Nucleonics 17, No. 6, 86-94(1959) June.

Several designs of Geiger-Mueller tubes and their applications in radiation detection instruments are discussed. Drawings of nine tube designs are shown and their applications listed. Performance curves for several tubes are shown. (A.C.)

16179

LOW-LEVEL NEUTRON DOSIMETRY WITH SENSITIVE FOIL METHODS. Paul Kruger (Nuclear Science and Engineering Corp., Pittsburgh). Nucleonics 17, No. 6, 116-18; 120; 122-4; 126; 130(1959) June.

Foil dosimetry techniques were developed for measuring small neutron fluxes in spent-fuel food irradiation facilities. The techniques are generally applicable for all neutron fluxes between 0.5 and 10^4 n/cm^2/sec. In gamma facilities where fission products are the source of radiation, neutron production is expected from (γ,n) reactions. This is particularly true of freshly discharged fuel elements in which 12.8-day Ba^{140} has not had time to decay. Properties of detector foils and neutron fluxes in three gamma facilities are tabulated. (A.C.)

16180

LOS ALAMOS PLASMA THERMOCOUPLE. G. M. Grover (Los Alamos Scientific Lab., N. Mex.). Nucleonics 17, No. 7, 54-5(1959) July.

The operation of a thermionic cell in which an ionized cesium gas fills the space between anode and cathode is described, establishing the feasibility of converting heat from fissioning material directly into electricity. The "plasma thermocouple" operating in the core of a reactor generated closed circuit currents as high as 35 amperes and open-circuit voltage of 3.8 volts, indicating a power output of 30 watts. (A.C.)

16181

APPARATUS FOR THE SELECTION IN COSMIC RADIATION OF A GENUINE PARTICLE WITH MASS AROUND 550 m_e. M. Conversi, G. M. De' Munari, A. Egidi, E. Fiorini, S. Ratti, C. Rubbia, C. Succi, and G. Torelli (Università, Milan and Pisa, Italy and Istituto Nazionale di Fisica Nucleare, Milan and Pisa, Italy). Nuovo cimento (10) 12, 130-7(1959) Apr. 16. (In Italian)

A report is given on problems solved or being solved on the reduced machine and on some experiments with modern computing techniques. (auth)

16182

A NEW TYPE OF DIFFERENTIAL DISCRIMINATOR OF RAPID PULSES. C. Rubbia and G. Torelli (Università, Pisa, Italy and Istituto Nazionale di Fisica Nucleare, Pisa, Italy). Nuovo cimento (10) 12, 144-7(1959) Apr. 16. (In Italian)

A new type of pulse-height analyzer using a beam deflection tube is described. The use of these tubes allows such a circuit to work at high repetition rate, without structural complexities. (auth)

16183

A GAS CHERENKOV COUNTER WITH HIGH YIELD. M. Beneventano (Istituto Nazionale di Fisica Nucleare, Rome); E. De Agostino, C. A. Galtieri, and A. Serra (C.N.R.N., Rome); and B. Rispoli (Università, Rome and C.N.R.N., Rome). Nuovo cimento (10) 12, 156-63 (1959) Apr. 16. (In Italian)

The performance of a CO_2 Cherenkov counter was studied. The efficiency of the counter for μ mesons of cosmic rays with momentum greater than 1.75 Bev/c was measured as a function of gas pressure. Preliminary results give for the efficiency the value (96.7 ± 1.1)% at the pressure of 10.23 atm. N.P.T. (auth)

16184

THE SIMULTANEOUS MEASUREMENT OF PARTICLE MOMENTUM AND IONIZATION IN A CLOUD CHAMBER. Bruno Brunelli (Università, Rome). Ricerca sci. 29, 930-45(1959) May. (In Italian)

The difficulties in the construction of a cloud chamber for the simultaneous measurement of particle momentum and ionization are described. The inherent limitations to the accuracy obtainable in the measurement of the two magnitudes are studied, and the optimum conditions for maximum accuracy are reviewed. These theoretical accuracies are compared with the accuracies obtainable in the best existing cloud chambers. (tr-auth)

16185

CRYSTALLINE CdS GAMMA-RADIATION RECEIVERS. I. D. Konozenko and V. I. Ust'yanov (Inst. of Physics, Academy of Sciences, Ukrainian, S.S.R., Kiev). Soviet Phys.-Solid State 1, 81-5(1959) Jan.

The preparation of CdS specimens sufficiently sensitive to x and gamma radiation to be used without phosphors and amplifiers is described. Single crystals and polycrystalline samples of CdS grown from the vapor phase were resublimed in a quartz tube. Their dark resistance ranged from 10^9 to 10^{13} ohms and their sensitivity ranged from 0.8×10^{-3} to 7.0×10^{-3} μ amp/μ r/sec for a 24 mc (O^{60} source). (T.R.H.)

16186

GENERAL HANDBOOK FOR RADIATION MONITORING. Jerome E. Dummer, Jr. Washington, D. C., U. S. Atomic Energy Commission, 1958. 185p. $0.60(GPO).

Basic data on radiation monitoring are presented as the third edition of the handbook. The most up-to-date data for permissible exposures and body burdens are included as well as descriptions of monitoring instruments and techniques, dosimetry, and protective equipment. (J.R.D.)

16187

IMPROVEMENTS IN OR RELATING TO SCALING CIRCUITS. George Brian Barrie Chaplin (to United Kingdom Atomic Energy Authority). British Patent 815,999. July 8, 1959.

A binary scaling circuit is described which operates at higher speed by elimination of the capacitative memory of the Eccles–Jordan circuit. Two electronic switches (tubes, transistors) are connected by their emitters or cathodes with resistive coupling between the collector or anode of the first and the control grid or base of the second, and connection of the base or control grid of the first to a fixed potential. Thus when one conducts the other is non-conducting. When both are rendered non-conducting by an input pulse to the emitters or cathodes, the control grid of the second is biased during the pulse and conducts after the pulse. An inductor is connected in series with the anode of the second switch, and an a-c coupling is provided between the inductor and the control grid or base of the first switch so that the preferential bias is reversed by voltage generated in the inductor when the second switch is switched from conducting to non-conducting. The inductor is the primary of a transformer whose secondary is the a-c coupling. This circuit can be series connected as several stages to give a higher scaling factor. (T.R.H.)

16188

METHOD AND APPARATUS FOR MEASURING THE THICKNESS OF A DEPOSIT. Pierre Pascal Martinelli (to Commissariat à l'Énergie Atomique). British Patent 816,062. July 8, 1959.

A method and device are given for measuring the thickness of a deposited layer of material. The device consists of: a beta source which excites the x-ray spectrum of the material whose thickness is to be measured, an x-ray filter to filter out all but a narrow band of the spectrum, and a scintillator and photomultiplier for measuring the intensity of x rays of selected energy. (T.R.H.)

16189

PRECISION TIME-DELAY GENERATOR. Barney J. Carr and Vernon D. Peckham (to U. S. Atomic Energy Commission). U. S. Patent 2,891,155. June 16, 1959.

A precision time-delay generator circuit with low jitter is described. The first thyratron has a series resonant circuit and a diode which is connected to the second thyratron. The first thyratron is triggered at the beginning of a time delay and a capacitor is discharged through the first thyratron and the diode, thereby, triggering the second thyratron. (T.R.H.)

ISOTOPES—INDUSTRIAL TECHNOLOGY

16190

USING ISOTOPES TO MEASURE LOW PRESSURES. G. Frederick Vanderschmidt (National Research Corp., Cambridge, Mass.). Electronics 32, No. 25, 60-1(1959) June 19.

The instrument described can measure pressures between sea level and 300,000 ft. The pressure-sensing transducer of the instrument is a small cylindrical tube with a thin foil of titanium—tritium fastened around the inside of the tube. Output is a digital signal which can be used for storage or telemetering more conveniently than an analog signal. (W.D.M.)

METALLURGY AND CERAMICS

16191 58-GL-50

General Electric Co. General Engineering Lab., Schenectady, N. Y.

EVALUATION OF ROLLING CONTACTS IN THE RANGE OF 550° TO 1000°F. S. F. Murray and P. Lewis. Feb. 7, 1958. 114p.

An experimental study was made on rolling contacts in the temperature range of 550 to 1000°F. Variables such as material composition, hardness, and operating conditions were investigated in a rolling test stand. Ball bearing tests were run to determine the effect of design parameters, bearing materials, lubricants, and operating conditions. (auth)

16192 AAEC/E-12

Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales.

PARTICLE SIZE ANALYSIS OF TUNGSTEN METAL POWDER. H. J. de Bruin and R. C. Cairns. May 1957. 17p.

A method of particle size analysis for sub-sieve, tungsten metal powder has been developed using the Andreasen pipette. Use of $\frac{1}{4}$ per cent by volume of tungsten powder in demineralized water gives minimum agglomeration. The method is useful for comparing the distribution of different batches of tungsten powder. No correlation between results from this method and the microscopic counting method used by the suppliers of the powder was found. (auth)

16193 AD-207760

Crucible Steel Co. of America. Research Div., Pittsburgh.

TITANIUM COATING PROGRAM. PHASE I: LITERATURE SURVEY. Interim Report I. W. H. Schaefer, Jr. and H. B. Bombarger. Oct. 15, 1958. 33p. Contract AF33(600)-37425.

A survey was made of coating literature, and organizations were contacted who may have an interest in the high-temperature protection of titanium during fabrication. High-temperature protection is the most important quality sought, but characteristics such as ease of application, green or unfired adhesion, and high-temperature bonding must also be considered. Protective coatings include ceramic, metallic, inorganic, and organic materials alone or in combination. Methods of application include spraying, dipping, brushing, electroplating, vapor deposition, and flame spraying. Possible ceramic coating compositions are numerous with the effective temperature range being determined by the refractory-flux ratio. For this application, some of the fluxes are refractory enough to be used alone. Hot-dipped aluminum coatings are the most widely studied metallic coatings for titanium. A nickel-plated coating is said to increase hydrogen pickup rather than reduce it. It appears that a coating will have to be developed if it is to meet all of the important qualities. (auth)

16194 ARC-CP-380

Gt. Brit. Aeronautical Research Council.

REGULARITIES IN CREEP AND HOT FATIGUE DATA. PART II. K. F. A. Walles and A. Graham. Dec. 1956. 140p.

The theory of regularities in creep and hot-fatigue data are compared with 103 sets of published creep-rupture, creep rate, and hot fatigue data relating mainly to alloys of the iron, nickel, chromium, and cobalt system of 44 different compositions. The results of all analyses are tabulated, and a statistical assessment of the extent of agreement of the theory with the data are given with reference to the number of free constants used. (J.E.D.)

16195 ARF-2120-4

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

NIOBIUM PHASE DIAGRAMS—MANUSCRIPT REPORT ON NIOBIUM—CARBON SYSTEM. Rodney P. Elliott. May 6, 1959. 29p. Contract AT(11-1)-515. $4.80(ph), $2.70(mf) OTS.

The niobium—carbon system has been determined by x-ray and metallographic examination of sintered and arc-cast alloys. Two carbides exist: hexagonal Nb_2C with a limited range of homogeneity, and cubic NbC with a solubility range from 8.25 to 10.25 weight per cent carbon. Dilute alloys freeze by eutectic reaction at 2230°C. The solubility of carbon in niobium is 0.80 at the eutectic temperature, but this decreases rapidly with temperature. Metallographic evidence indicates a peritectic reaction between melt, Nb_2C, and NbC; alloys richer in carbon than NbC freeze by eutectic reaction. (auth)

16196 BMI-1307
Battelle Memorial Inst., Columbus, Ohio.
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING DECEMBER, 1958. Russell W. Dayton and Clyde R. Tipton, Jr. Jan. 1, 1959. Decl. June 12, 1959. 82p. Contract W-7405-eng-92. $2.25(OTS).

Thermal-conductivity measurements were completed from 100 to 600°C on UO_2 specimens. An investigation of the creep properties of annealed and of 15% cold-worked Zircaloy-2 in the 290 to 400°C temperature range is being conducted. Research to develop a method of sink-float density measurements to identify factors affecting irradiation-induced volume changes in graphite was continued. An increase in the U content of Al—U alloys is desirable as a means of increasing the fuel loading of reactors utilizing these fuels. The development of the radiometric method for the analysis of Mg in cement was completed. A study of the solidification of U castings in cylindrical graphite molds is being conducted. Experimental work was continued to reduce the amount of additive oxide (La_2O_3, CaO, and Y_2O_3) required to achieve stabilization of uranium oxides. Additional H_2-adsorption isotherms were obtained for the Zr—25 wt. % U alloy. An irradiation surveillance program is being conducted to determine the effect of fast neutrons on the mechanical properties of type 347 stainless steel. The study concerned with the properties of Nb—U alloys was continued. A program is being conducted to investigate methods for improving the irradiation behavior and corrosion properties of Th—U alloys. An investigation is being made of cermet fuel materials consisting of from 60 to 90 vol. % of UO_2, UN, or UC dispersed in stainless steel. Gas-pressure bonding of Mo- and Nb-clad fuel elements is reported. A study to evaluate the irradiation resistance of dispersion fuel elements consisting of UC or UN fuel dispersed in a stainless steel matrix clad with stainless steel is reported. Fatigue studies of Inconel and INOR-8 are reported. A study of the constitution of U—Nb alloys is being conducted. Fundamental studies are being made of the kinetics and mechanism of the reaction of N_2 with Nb. The examination and evaluation of six 1.5-inch-diameter fueled (UO_2) graphite spheres after irradiation is reported. Localized attack on Ti steam tubes exposed to Darex dissolver solutions appears to be connected with defective areas in the tubes. Heat treatment of Ni-o-nel for 0.5 hr at 1850°F with an air quench following welding has produced the most resistance to Thorex solutions of any treatment studied. The conditions prevailing during dissolution of Type 304 stainless steel in boiling 6 $\underline{M}$ H_2SO_4 give corrosion rates in the range of 2 to 3 mils per month for Ni-o-nel specimens exposed to the vapor. Scouting experiments have shown the Zirflex decladding solution to be excessively corrosive to Type 347 and Carpenter 20 Cb stainless steels and Ni-o-nel. Raising the temperature from 650 to 700°C practically doubles the corrosiveness of the equimolar $NaF-ZrF_4$ salt. The evaluation of UC as a fuel for the SRE is proceeding. The amount of fission product Xe^{133} released from UC as a function of time and temperature of post-irradiation heating was determined. The results of measurements of fission-gas release from Th—11 wt. % U specimens are reported. The effects of radiation and corrosion by the organic moderator on certain structural materials planned for use in the Organic Moderated Reactor are being studied. Properties of arc-melted Ta and Ta—W alloys are presented. A flat-plate Zircaloy-2-clad fuel element containing compartmented UO_2 fuel is being considered for Core 2 of the PWR. The postirradiation examination of two stainless steel-clad UO_2 specimens for the Maritime Gas-Cooled Reactor program is continuing. Experiments leading to the development of a $BeO-UO_2$ fuel element were begun. (For preceding period see BMI-1304.) (W.L.H.)

16197 BMI-1315
Battelle Memorial Inst., Columbus, Ohio.
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING JANUARY, 1959. Russell W. Dayton and Clyde R. Tipton, Jr. Feb. 1, 1959. Decl. June 12, 1959. 86p. Contract W-7405-eng-92. $2.25(OTS).

Thermal-conductivity measurements are in progress on an unirradiated, unclad, natural U specimen. Data are presented on thermal conductivity measurements performed on UO_2. The creep properties of annealed and of 15% cold-worked Zircaloy-2 are being studied. A program was initiated to evaluate loss-of-coolant incidents in the PRTR by means of simulation on a digital computer. Research on the casting of hollow Al—35 wt. % U extrusion billets is reported. Further refinement of the method developed for the analysis of Mg in cement is in progress. The infrared and gas-chromatography analysis of irradiated dodecane, decane, cetane, and octane, and their urea complexes, were continued. The manner in which U metal solidifies in cylindrical graphite molds is under study. Work has continued on development of a stabilized high-temperature nuclear fuel capable of operation in either oxidizing or reducing atmospheres. Progress in the study of potential fueled moderators has continued with the determination of hydrogen-absorption isotherms for the Zr—25 wt. % U alloy. The effect of fast-neutron flux on the mechanical properties of AISI Type 347 stainless steel are being determined and evaluated. The forging of Nb—U alloys is reported. Thorium—uranium alloys are being studied for the purpose of developing improved corrosion resistance and irradiation stability of the alloy by means of alloying and control of processing variables. The causes of fission-gas loss from refractory fuel materials is being investigated. Cermet fuel materials consisting of from 60 to 90 vol. % UO_2, UN, or UC dispersed in a stainless steel or Nb matrix are being investigated. The gas-pressure bonding technique is being investigated for cladding and bonding Nb- and Mo-base fuel elements and assemblies. Dispersion fuels consisting of UC and UN dispersed in stainless steel were irradiated in the MTR. Stress-cycling tests were continued on Inconel specimens at 1300 and 1500°F, cycled at 1 cps. The investigation of temperature and frequency dependence of fatigue properties of INOR-8 alloy is being investigated. Studies of U compounds and the mechanism of thermal migration of hydrogen in zirconium are in progress. In the research on thermal migration of H_2 in Zr, new data on the diffusion coefficients of H_2 in beta Zr were obtained. Data are presented on postirradiation examination of three pairs of fueled-graphite spheres. The evaluation of materials of construction for use in the Darex, Sulfex-Thorex, Zirflex, and Fluoride-Volatility processes of nuclear fuel recovery was continued. Uranium carbide containing 5 wt. % carbon is being studied as a fuel for the SRE. A study of the properties of Ta—W alloys is continuing. A compartmentalized flat-plate Zircaloy-2-clad fuel element containing UO_2 cores is being considered for PWR Core-2. Techniques for the fabrication of graphite-matrix fuel cores containing 20 vol. %

UC in form of UC and UC_2 are reported. (For preceding period see BMI-1307.) (W.L.H.)

16198 BMI-1318
Battelle Memorial Inst., Columbus, Ohio.
STABILIZATION OF UO_2 BY VALENCE COMPENSATION. Wendell B. Wilson. Feb. 4, 1959. 28p. Contract W-7405-eng-92. $1.00(OTS).

UO_2, when heated in air, will transform to U_3O_8. The U_3O_8 which is formed exhibits appreciable vapor pressure at temperatures in excess of 1200°C. The need for a stable high-temperature nuclear fuel requires prevention of the U_3O_8 transformation as well as a lowering of the vapor pressure. A method by which this may be accomplished involves compensation of the valence change of U, as it undergoes oxidation. This is accomplished by massive addition of other metal oxides. Solid-state studies of the U—La—O system were conducted in the investigation to elicit more detailed understanding of the processes involved. The oxidation and vaporization characteristics of UO_2 were compared directly to solid solutions of UO_2 containing from 30 to 60 wt.% of La_2O_3. These solid solutions, which have the fluorite structure, were formed by reacting UO_2 and La_2O_3 *in vacuo*. When these materials were oxidized the fluorite structure was retained with, however, reduced lattice parameters. These were shown to be equivalent to reacting U_3O_8 with La_2O_3. The volatility of the resulting solid solutions was found to vary with the amount of additive. The composition exhibiting the lowest vapor pressure was further related to a stoichiometry between the cation and anion content. The usual approach in alloying to improve oxidation resistance is to retard the rate of oxidation. The present approach differs in that the alloying material is added to stabilize the structure and results in rapid oxidation. However, since no phase change is involved marked improvement in stabilization is obtained. An attempt to generalize the concepts developed for application to other oxide systems is made. (auth)

16199 BMI-1349
Battelle Memorial Inst., Columbus, Ohio.
COATING OF GRAPHITE WITH SILICON CARBIDE BY REACTION WITH VAPOR OF CONTROLLED SILICON ACTIVITY. John M. Blocher, Jr., Don P. Leiter, Jr., and Robert P. Jones. June 15, 1959. 17p. Contract W-7405-eng-92. $0.75(OTS).

In the reaction of silicon halides with graphite to form silicon carbide, thermodynamic conditions were determined for the formation of SiC, free of elemental silicon. The use of these conditions was designed to limit the rate of coating formation by the rate of diffusion of carbon through the coating, and render the operation independent of the vapor-flow factors which normally limit the uniformity of vapor-deposited coatings. Although a wide range of pressure-temperature-composition conditions was explored, it was not possible to duplicate the success previously obtained in applying the method to NbC, TaC, TiC, and ZrC coatings. Fundamental differences in the characteristics of the carbides which may account for the difference in behavior are the lack of a range of homogeneity in beta SiC crystal structure, and the fact that SiC undergoes a modification from the cubic beta to a hexagonal form at 1900 to 2000°C. There remains the prospect of forming a uniform SiC "sponge" by the present process which can be subsequently impregnated with metallic silicon to form an oxidation-resistant coating. (auth)

16200 CF-58-12-24
Oak Ridge National Lab., Tenn.
FUEL VALUE OF PLUTONIUM—PRELIMINARY REPORT. Paul R. Kasten. Dec. 5, 1958. 29p. Contract [W-7405-eng-26]. $4.80(ph), $2.70(mf) OTS.

Preliminary results were obtained on the value that commercially pure Pu (95% Pu^{235} and 5% Pu^{240}) has when used as nuclear fuel. The fuel value of Pu was taken to be such that the optimum Pu-fueled reactors have the same fuel costs as the optimum U-fueled reactors. For a given Pu value, that U enrichment which gave the minimum fuel cost was termed the optimum enrichment. This same procedure was used for the Pu-fueled reactors. For a given Pu value, the fuel cost was calculated as a function of Pu enrichment. That enrichment which gave minimum fuel cost was termed the optimum Pu enrichment. The fuel cost of the optimum U-fueled reactors was then plotted against the assumed Pu value. The same was done for the Pu-fueled reactors. The value of Pu corresponding to the crossing point of these curves was termed the fuel value. (W.L.H.)

16201 CF-59-1-15(Rev.1)
Oak Ridge National Lab., Tenn.
EUROCHEMIC ASSISTANCE: ORNL REVIEW OF EUROCHEMIC "STAINLESS STEEL MATERIALS." E. M. Shank. Jan. 14, 1959. 12p. $3.30(ph), $2.40 (mf) OTS.

Comments of qualified ORNL personnel on the proposed materials of construction for the Purex portion of the Eurochemic plant are reported. Persons commenting are E. C. Miller, G. M. Adamson, C. H. Wodtke, J. L. English, and P. Patriarca. Included is the condensation of information from a Eurochemic meeting to discuss these materials of construction. (auth)

16202 CF-59-4-44
Oak Ridge National Lab., Tenn.
QUARTERLY REPORT OF THE SOLUTION MATERIALS SECTION FOR THE PERIOD ENDING APRIL 30, 1959. J. C. Griess, H. C. Savage, R. S. Greeley, J. L. English, S. E. Bolt, D. N. Hess, P. D. Neumann, A. J. Shor, E. S. Snavely, and W. C. Ulrich. Apr. 30, 1959. 67p. Contract [W-7405-eng-26]. $10.80(ph), $3.90(mf) OTS.

Studies concerned with the deposition of salts from simulated fuel solution under boiling conditions were continued. Additional deposition tests were carried out in loop L-2-23 in which the core section was heated. Several reagents were tested to determine their ability to dissolve stainless steel corrosion products. A simulated HRT fuel solution was stable with regard to U concentration when diluted to 23 ppm at 250°C; however, some Cu was lost from solution. Preliminary tests in a uranyl sulfate solution indicate that an 18-8 stainless steel alloyed with either small amounts of Pt or Cu is more corrosion resistant at low flow rates than a conventional 18-8 stainless steel; however, the addition of either Cu or Pt did not reduce the corrosion rate of 18-8 stainless steel at high flow rates. A study was made to determine the susceptibility of off-specification type 347 stainless steel to intergranular attack by uranyl sulfate solutions. Continued testing with a single heat of cast type 347 stainless steel has confirmed previously reported data to the effect that the cast alloy is more resistant to stress-corrosion cracking than is the wrought alloy. Six commercial grades of Al_2O_3 suitable for use as check balls in valves in slurry service were corrosion tested in static slurry environments. Corrosion tests with Uniloy 19-9DL showed that the alloy in the annealed and in the annealed and aged condition has corrosion resistance similar to that of type 347 stainless steel in simulated reactor fuel solution and has less tendency to gall than the austenitic stainless steels. (For preceding period see CF-59-1-79.) (W.L.H.)

16203 DMIC-114
Battelle Memorial Inst., Defense Metals Information Center, Columbus, Ohio.
DUCTILE-BRITTLE TRANSITION IN THE REFRACTORY METALS. F. R. Schwartzberg, H. R. Ogden, and R. I. Jaffee. June 25, 1959. 78p. Contract AF18(600)-1375. (AD-216526; PB-151070).

Ductile-brittle transition behavior occurs in the body-centered cubic refractory metals niobium, molybdenum, tungsten, and chromium. The available data for vanadium suggest that brittleness at low temperatures is attributable to low-strain-rate hydrogen embrittlement. However, the occurrence of ductile-brittle transition behavior is not precluded. No brittle transition has yet been found in tantalum. Transition temperature can be greatly influenced by testing and material conditions. As a general rule, the following factors increase the temperature at which the brittle transition occurs: recrystallization, decreasing amounts of cold work, increasing grain size, increasing interstitial content, increasing strain rate, and introduction of triaxial stresses. The transition from ductile to brittle behavior is associated with a rapid rise in yield strength occurring with reductions in temperature. Brittle behavior is observed to occur when the yield strength equals the fracture strength. Cottrell's theory of dislocation locking by interstitial atoms is generally used to explain the yield-strength rise at low temperatures. (auth)

16204 HW-59134
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
ROTO-ARC WELDING. J. C. Tverberg. Apr. 1, 1959. 26p. Contract W-31-109-Eng-52. $0.75(OTS).

A high intensity ion beam moving in a magnetic field has been investigated as a means of effecting closure on Hanford type fuel elements. The investigation was successful in producing a high speed process, but the weld results were not consistent with present fuel element specifications. Other disadvantages were silicon contamination in the weld metal, poor electrode life, and difficulty in controlling the weld width. (auth)

16205 HW-60660
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
CORROSION EQUIPMENT PROTOTYPE. G. E. Neibaur. June 9, 1959. 9p. $3.30(ph), $2.40(mf) OTS.

A new package-type facility for corrosion and decontamination studies was designed and fabricated. The corrosion equipment consists of a stainless steel, pressurized water circulation loop capable of operation at 600°F and 2000 psi. A complete set of drawings is included. (J.E.D.)

16206 IGO-TM/C-020
United Kingdom Atomic Energy Authority. Industrial Group. Culcheth Labs., Culcheth, Lancs, England.
THE MELTING OF REFRACTORY METALS BY ELECTRON BOMBARDMENT. H. N. Jones. Dec. 12, 1955. 14p.

A furnace capable of melting refractory metals by electron bombardment has been constructed, and niobium buttons have been melted successfully. Tungsten, molybdenum, and thorium have been partially melted, but complete melting has been prevented by electrical instability which is associated with the appearance of positive ions in the furnace. (auth)

16207 ISC-1050
Ames Lab., Ames, Iowa.
SEMI-ANNUAL SUMMARY RESEARCH REPORT IN METALLURGY FOR JANUARY—JUNE 1958. Mar. 1, 1959. 93p. Contract W-7405-eng-82. $2.25(OTS).

Separation Studies. Exploratory work has continued on the liquid-liquid separation of inorganic materials. It was shown that U can be separated from Th by extracting the Th with Mg. The distribution of Pa^{233} between Mg—Th and U—Cr alloys was investigated. The distribution of Pa between Mg—Th solutions and fused salts containing $MgCl_2$ is reported. The pyrometallurgical purification of U was investigated. Preparation of Pure Compounds. Work was continued on the preparation of V_2O_5 in pound lots by the chlorination method. High-pressure equipment was obtained and installed, and several compounds were prepared for the synthesis of V and Nb carbonyl compounds. Studies have continued on the preparation YF_3 by heating of the oxide in an anhydrous HF stream at elevated temperatures. Metal Preparation and Purification Studies. A small vycor bulb was used in studies on the growth rate and efficiency of the process for purifying V metal by the thermal decomposition of vanadium iodide. The preparation of Nb metal by various means is reported. The pyrex-glass apparatus for purifying Th has been yielding ~250g per run. Work has continued on the reduction of ThF_4 with Ca and Mg to give a low melting Th—Mg alloy and a low-melting slag. The production of Y metal on a pilot plant scale was continued. Work continued on the carbon reduction of uranium oxide to U metal. Methods for producing high-purity Ta metal are being investigated. A method was investigated for producing high-purity Ba metal. Alloy Investigations. The phase relations and thermodynamic properties of Th—Zn system were investigated. Investigation of the Th—Y alloy was undertaken for studying the solid state phase interactions at high temperatures. The preparation of a Mg—Th alloy is reported. An investigation of the properties and phase relationships of the Y—Nb system was started. The shape of the phase diagram of the Th—Mo alloy was established. Crystallographic and phase relationships of the Ni—Zr and Ni—Hf alloys are reported. Phase studies of the U—Hf alloy are reported. The study of the Ti—Y alloy system was continued. An investigation of the Y—Mg system was initiated. Studies on the preparation of Al—Nb alloys are reported. Melting point, temperature resistance, metallographic and x-ray data were collected in an attempt to determine the solubility limits of Th in V. An investigation of the Ba—BaH_2 system was started to provide basic information on metal-metal hydride systems. The magnetic susceptibility of crystal bar Th was measured in the temperature range 130 to 300°K. The linear coefficients of thermal expansion of calcium metal were measured for (f)cc calcium and (b)cc calcium. Measurements of the five independent elastic constants of single crystalline Be as a function of temperature are in progress. Attempts to grow single crystals of Y for use in the measurement of elastic constants by ultrasonic methods and to study the deformation modes in the metal were made. The structure of U_2Zn_{17} is being investigated. The samples of Y metal to which known amounts of N_2 was added were analyzed by vacuum fusion. The rate of absorption of H_2 by Th at constant pressure and temperature was measured from 450 to 700°C at pressures up to 400 mm. (For preceding period see ISC-977.) (W.L.H.)

16208 LA-1000
Los Alamos Scientific Lab., N. Mex.
ALLOYS OF PLUTONIUM WITH ALUMINUM. R. D. Moeller and F. W. Schonfeld. Feb. 13, 1950. Decl. Mar. 26, 1957. 71p. Contract [W-7405-eng-36]. $12.30(ph), $4.50(mf) OTS.

On the basis of incomplete data, tentative suggestions are made concerning features of the equilibrium diagram of aluminum—plutonium alloys. Data, deductions, and speculations are presented graphically as a tentative phase diagram. (J.E.D.)

16209 LAMS-1823
Los Alamos Scientific Lab., N. Mex.
BIBLIOGRAPHY ON IMPACT TESTING OF MATERIALS. Jean Fick. July 8, 1952. 39p. $6.30(ph), $3.00(mf) OTS.

A bibliography on impact testing of materials is presented. Various sources were investigated such as Chemical Abstracts, 1947-50, Metallurgical Abstracts, Vols. 1-18, ASM Review of Metals Literature, Vols. 1-6, J. Institute of Metals, Vols. 78-80 (No. 7), and Physics Abstracts, 1937-50. (J.R.D.)

16210 MAB-138-M
National Research Council. Materials Advisory Board.
BASIC PROPERTIES FOR COMPARATIVE EVALUATION OF HIGH STRENGTH STEELS FOR ELEVATED TEMPERATURE APPLICATIONS IN AIRCRAFT. Apr. 20, 1959. 21p. Contract DA-36-039-sc-76436.

Basic properties for comparative evaluation of high-strength heat-resistant steels are tabulated. The tables were prepared by the Ad Hoc Panel on basic properties of high-strength alloy and stainless steels and are believed to improve clarity and reduce test expenses. It is pointed out that elevated test procedure standardization needs attention, and ARTC and ASTM are urged to promulgate mutually acceptable standards. (J.R.D.)

16211 MAB-139-M(A1)
National Research Council. Materials Advisory Board.
FIRST PROGRESS REPORT BY THE PANEL ON AIRCRAFT APPLICATIONS OF THE MATERIALS ADVISORY BOARD COMMITTEE ON THE DEVELOPMENT OF MANUFACTURING PROCESSES FOR AIRCRAFT MATERIALS (AMC). June 1, 1959. 25p. Contract DA-36-039-sc-76436.

A summary of the proceedings of the Panel on Aircraft Applications of the Materials Advisory Board is presented. Included is a review of current and proposed projects directed toward the development of aircraft hardware. Comments of the Panel are also reported. (J.R.D.)

16212 MAB-139-M(F2)
National Research Council. Materials Advisory Board.
SECOND PROGRESS REPORT BY THE PANEL ON FORGINGS AND EXTRUSIONS OF THE MATERIALS ADVISORY BOARD COMMITTEE ON THE DEVELOPMENT OF MANUFACTURING PROCESSES FOR AIRCRAFT MATERIALS (AMC). June 8, 1959. 15p. Contract DA-36-039-sc-76436.

A melting of the Panel on Forgings and Extrusions of the Materials Advisory Board Committee is reported. A review of new projects is given along with various recommendations developed during the review and suggestions with respect to additional projects that should be given consideration. Also, a proposed framework for the development of a program directed to the solution of problems within the next five to ten years is presented. (For preceding period see MAB-139-M(F1).) (J.R.D.)

16213 MAB-139-M(R1)
National Research Council. Materials Advisory Board.
FIRST PROGRESS REPORT BY THE PANEL ON ROLLING, COLD FORMING AND COLD EXTRUSION OF THE MATERIALS ADVISORY BOARD COMMITTEE ON THE DEVELOPMENT OF MANUFACTURING PROCESSES FOR AIRCRAFT MATERIALS (AMC). June 12, 1959. 31p. Contract DA-36-039-sc-76436.

Panel comments and recommendations with respect to specific projects are reviewed, and suggestions for additional programs are presented. (W.L.H.)

16214 MAB-140-M
National Research Council. Materials Advisory Board.
AVAILABILITY OF WIDE, THIN GAGE, CLOSE TOLERANCE TITANIUM AND TITANIUM ALLOY SHEET AND STRIP. June 2, 1959. 70p. Contract DA-36-039-sc-76436.

A survey of the primary Ti sheet producers is presented with the emphasis on progress in the industry toward producing wide, close tolerance, high strength Ti and Ti alloys. The survey was conducted during the period between October 13 and 18, 1958. Details and results of visits to currently producing plants are given along with survey conclusions. (J.R.D.)

16215 MAB-148-M
National Research Council. Materials Advisory Board.
UNIFORM TESTING PROCEDURES FOR SHEET MATERIALS. CREEP TESTING PROCEDURES RECOMMENDED BY THE SUBPANEL ON UNIFORM PROCEDURES FOR STRUCTURAL DESIGN DATA COLLECTION OF THE DEPARTMENT OF DEFENSE TITANIUM ALLOY SHEET ROLLING PROGRAM. May 29, 1959. 8p. Contract DA-36-039-sc-76436.

Creep testing procedures to be used in evaluation of Ti alloys are presented. Adherence to these procedures allows several laboratories to perform tests and compare data on a uniform basis. Items common to all creep tests are included; however, detailed procedures for individual tests are given in referenced sections. (J.R.D.)

16216 NP-7611
Gt. Brit. Inter-Services Metallurgical Research Council, London.
CORROSION AND ITS PREVENTION AT BIMETALLIC CONTACTS. July 1958. 10p. $0.35(BIS).

The extent to which the rate of corrosion of one metal is affected by contact with a dissimilar metal immersed with it in a corrosive liquid and means of mitigating the effect are discussed. (J.E.D.)

16217 NP-7651
Michigan. Univ., Ann Arbor.
GAS TURBINES AND FREE PISTON ENGINES. Lecture No. 5 [on] HIGH TEMPERATURE MATERIALS. An Intensive Course for Engineers. James W. Freeman. 1958. 26p.

A lecture on high-temperature materials is presented. Alloys of metals such as Mo, Cr, W, Nb, and Ta are discussed in relation to high-temperature development. In addition, production technology and effects of trace elements are examined. Also, preparation techniques such as vacuum melting, consumable-electrode cold mold melting, and hot working are discussed. The relation of service conditons to properties is summarized. (J.R.D.)

16218 NP-7699
Westinghouse Electric Corp. Research Labs., Pittsburgh.
UNUSUAL CRYSTAL GROWTHS OBSERVED IN THE HIGH-TEMPERATURE CORROSION OF 304 STAINLESS STEEL AND IRON. Research Report 6-94602-1-R5. Earl A. Gulbransen, Thomas P. Copan, and Daniel van Rooyen. Sept. 18, 1957. 19p.

Electron microscope and electron diffraction studies were made on the corrosion products formed on 304 stainless steel and iron in dry air and oxygen, oxygen saturated at 25°C with water vapor, and oxygen saturated at 25°C with H_2O vapor plus a few parts per million of HCl vapor. In addition to the formation of the normal layer type of oxide film, many fine oxide whiskers were formed on iron at 500°C in wet and dry oxygen atmospheres. These whiskers grow nearly perpendicular to the surface and were 300 to 1000 angstroms thick and up to 470,000 angstroms long. The density of whiskers was 10^8 to 10^9 per cm^2. The oxide was $\alpha-Fe_2O_3$. With stainless steel, oxide whiskers of Cr_2O_3 were formed 100 to 500 angstroms thick and up to 50,000 angstroms in length. Some areas of the specimen were free from whiskers while other areas contain up to 10^8 whiskers per cm^2. In atmospheres containing HCl vapor at 600°C, fan shaped single crystals of Cr_2O_3 were formed. These grow nearly perpendicular to the surface and were about 100 angstroms thick, 10,000 to 5,000 angstroms in height and 100,000 angstroms long. These crystals appear in parallel layers. Pre-straining of the specimens with stress levels greater than the yield point greatly accelerates the growth of the fan shaped crystals. It was proposed that this crystal habit may be important in determining whether a given alloy is susceptible to stress corrosion cracking. (auth)

16219 NYO-2319
Southwest Research Inst., San Antonio.
CYCLIC PRESSURE TESTS OF LARGE SIZE PRESSURE VESSELS. Progress Report No. 8 for May 15, 1959 to June 15, 1959. M. M. Lemcoe. June 15, 1959. 16p. Contract AT(30-1)-2140. $3.30(ph), $2.40(mf) OTS.

The plastic fatigue strength of large-size pressure vessels is discussed. The pressure vessels considered are of a 36 in. ID with 2 in. wall thickness with nozzles of several designs and sizes. (auth)

16220 NYO-7550
Tufts Univ., Medford, Mass.
PRELIMINARY CONSIDERATIONS ON THE PARAMAGNETIC SUSCEPTIBILITY OF HYDRIDES AND AN APPARATUS AND ITS MEASUREMENT. Wallace A. Norder and Thomas R. P. Gibb, Jr. Apr. 15, 1959. 29p. Contract AT(30-1)-1355. $4.80(ph), $2.70(mf) OTS.

The ability of a metal to take up hydrogen exothermically is related directly to the paramagnetic susceptibility (PMS) of the metal. The PMS of the metal–hydrogen system may increase or decrease with hydrogen-content. A rather naive rationalization of this behavior is given in terms of the relative number of unpaired electrons in the normal metal, the metal cation, and the isolated ground-state atom. The behavior of several metal–hydrogen systems is examined on the basis of lattice distension and ionic character. A novel induction method for the measurement of susceptibility is described in detail, and preliminary observations on the titanium–hydrogen system are given. (auth)

16221 NYO-7564
Pennsylvania State Univ., University Park.
STRESSES IN CONTOURED NOZZLE E WHEN SUBJECTED TO EXTERNAL LOADINGS. Period covered: October 16, 1958 to May 15, 1959. D. E. Hardenbergh. May 26, 1959. 40p. Contract AT(30-1)-1874. $6.30 (ph), $3.00(mf) OTS.

The state of stress in the vicinity of a hot-formed contour-type nozzle with ID 12 in. and OD 12.75 in. issuing from a 12 ft, 20 in. OD, 18 in. ID pressure vessel were determined when external loadings were individually applied at the extremity of the branch pipe. The results show that external loads produce maximum stresses on the external surface of the outlet. Locations of maximum stress occur either on the transverse plane through the outlet or in a plane very close to the longitudinal plane of the main shell of the pressure vessel. (auth)

16222 RDB(C)/TN-20
Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.
DETERMINATION OF THE COEFFICIENT OF LINEAR THERMAL EXPANSION OF METALS AT T°C. S. M. Makin and P. Hunter. Mar. 2, 1953. 13p.

A dial gage dilatometer was used to determine the thermal expansion of 18/8/1 and 18/13/1 stainless steels and of cast uranium. The measurements were made under a vacuum of 2×10^{-3} mm Hg. Both types of steel showed linear expansion over the temperature range 20 to 900°C, the coefficients of expansion obtained being $1.88 \pm 0.03 \times 10^{-5}$ and $1.87 \pm 0.03 \times 10^{-5}{}^\circ C^{-1}$, respectively. Values of 1.64 to 1.70 ± 0.05, 2.20 ± 0.05, and $1.70 \pm 0.05 \times 10^{-5}{}^\circ C^{-1}$ were obtained for the coefficients of expansion of cast uranium in the α, β, and γ forms. The $\alpha-\beta$ and $\beta-\gamma$ transformations gave rise to changes in length of 0.7 and 0.4%. (auth)

16223 RDB(C)/TN-53
Gt. Brit. Culcheth Labs. Culcheth, Lancs, England.
THE HOT PRESSING OF URANIUM POWDER. AN ASSESSMENT OF THE FACTORS INVOLVED IN THE CHOICE OF DIE MATERIALS. G. D. Bell and S. M. Higham. Oct. 19, 1953. 14p.

The conditions in a die during hot pressing are considered in detail, and from this consideration the properties of an ideal die material are specified. Possible die materials for hot pressing uranium are discussed and compared with this ideal specification. Experimental work on cemented carbides compatible with uranium is recommended. (auth)

16224 RDB(C)/TN-66
Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.
STRESSES IN THE FAST FISSION REACTOR FUEL ELEMENTS. M. J. Makin. Mar. 8, 1954. 27p.

Stresses likely to arise in the fuel elements of the fast fission reactor due to its design and operation have been calculated using simple elastic theory. The effects of some of these stresses are briefly considered, and recommendations are made as to ways in which some of the more dangerous stresses may be eliminated or reduced. (auth)

16225 RDB(C)/TN-81
United Kingdom Atomic Energy Authority. Industrial Group. Culcheth Labs., Culcheth Lancs, England.
THE ARC MELTING OF REFRACTORY METALS. H. N. Jones. July 28, 1954. 19p.

The principles of arc melting and casting are described and various types of furnace compared. On the basis of experiments with a small laboratory furnace a large ingot casting furnace has been designed. It has been shown that when using an argon atmosphere there are no fundamental difficulties to be overcome. With a non-consumable upper electrode it has not yet been possible to maintain a stable arc below 0.2 mm pressure, and it is recommended that the ingot casting furnace should be operated in an argon atmosphere until this problem has been solved. (auth)

16226 RDB(C)/TN-84
Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.
THE PRODUCTION OF DUCTILE HAFNIUM-FREE ZIRCONIUM. W. E. Dennis and A. F. Adamson. June 30, 1954. 18p.

Current processes for the production of zirconium metal from its ores are reviewed, particular attention being given to methods for the removal of hafnium. Two main routes for the production of ductile hafnium-free zirconium are recommended for investigation. A synopsis of the more important chemical and physical properties of zirconium is given as an appendix. (auth)

16227 RDB(S)/TN-2021
Gt. Brit. Springfields Works, Springfields, Lancs, England.
PREPARATION OF PURE OXIDE REFRACTORIES BY SLIP CASTING. G. H. Chalder. Feb. 1, 1952. 10p.

Some existing techniques of slip casting in pure alumina are reviewed and a method evolved for the production of pure alumina ware. The experimental work has been confined to the production of small boats (6" long × $1\frac{1}{4}$" wide × $\frac{1}{2}$" deep). These boats were slip cast in a plaster of paris mould, dried, and subsequently fired at 1600°C in a molybdenum wound furnace. Suggestions are made for future work. (auth)

16228 RDB(S)/TN-2167
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
SOME PRIMARY PHASES IN THE MAGNESIUM–ALUMINIUM–CALCIUM SYSTEM. R. D. Stacey. 1958. 20p.

Slowly-cooled magnesium-rich alloys in this system were studied using x-ray and metallographic techniques. The intermediate phases occurring in "as-cast" Magnox alloys have been identified as Mg_{17} Al_{12} and a ternary phase $Mg_{1.3}$ $Al_{1.7}$ Ca. Heat treatment of the Magnox alloys results in these phases being taken into solid solution. The ternary phase $Mg_{1.3}$ $Al_{1.7}$ Ca has not been reported in the literature; it has a tetragonal structure with a = 8.12A, c = 11.40A and is apparently derived from the Ca Al_2 structure. (auth)

16229 TID-7567(Pt.1)
Nuclear Metals, Inc., Concord, Mass.
TECHNICAL PAPERS OF THE ELEVENTH METALLOGRAPHIC GROUP MEETING HELD AT BRIDGEPORT BRASS COMPANY, NOVEMBER 7 AND 8, 1956. H. P. Roth, comp. Jan. 12, 1959. 110p. $2.50(OTS).

Papers from the eleventh metallographic group meeting are presented. Included are papers on the fractography of U, electropolishing U and Th, anodizing Zr base alloys, metallographic studies of reactor poison materials, metallography of hot-pressed carbides, failures of Ti components, heat treatments of Hastelloy B, polishing and etching of Th and Th–U alloys, transformation studies on U–Mo alloys, and U grain size studies. (J.R.D.)

16230 TID-7567(Pt.1)(p.1-10)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
THE FRACTOGRAPHY OF URANIUM. T. K. Bierlein and B. Mastel. p.1-10 of TECHNICAL PAPERS OF THE ELEVENTH METALLOGRAPHIC GROUP MEETING HELD AT BRIDGEPORT BRASS COMPANY, NOVEMBER 7 AND 8, 1956. 10p.

Aspects of the fractography of U are discussed. This technique is a simple means for investigating the brittle–ductile characteristics of a metal. In the case of irradiated U it is a valuable adjunct to conventional metallography. For such applications, replication by an Al pressing method or with cellulose acetate is suggested. Also, application of these methods to nonirradiated U has provided a convenient reference for interpreting and evaluating future studies on irradiated U. (J.R.D.)

16231 TID-7567(Pt.1)(p.11-18)
Bridgeport Brass Co., Conn.
ELECTROPOLISHING OF URANIUM AND THORIUM. R. M. Treco, E. J. Hennessey, A. W. Grella, and M. F. Garufi. p.11-18 of TECHNICAL PAPERS OF THE ELEVENTH METALLOGRAPHIC GROUP MEETING HELD AT BRIDGEPORT BRASS COMPANY, NOVEMBER 7 AND 8, 1956. 8p.

Use of a butyl cellosolve–alcohol–perchloric acid electrolyte bath in the process of machining tensile bars of swaged U rod and in preparing extruded Th for metallographic examination is described. It is felt that this technique would be acceptable for production of stress free U bars. Thorium polishing results are illustrated by photomicrographs. (J.R.D.)

16232 TID-7567(Pt.1)(p.19-30)
Oak Ridge National Lab., Tenn.
ANODIZING AS A METALLOGRAPHIC TECHNIQUE FOR ZIRCONIUM BASE ALLOYS. M. L. Picklesimer. p.19-30 of TECHNICAL PAPERS OF THE ELEVENTH METALLOGRAPHIC GROUP MEETING HELD AT BRIDGEPORT BRASS COMPANY, NOVEMBER 7 AND 8, 1956. 12p.

An anodizing technique for use on Zr base alloys for phase identification is described. Improvements of optical contrast of microstructures in both bright field and polarized light examination are achieved, and the etched surface of the specimen is permanently preserved. The technique has also been used on U and Ta base alloys. (J.R.D.)

16233 TID-7567(Pt.1)(p.32-45)
Los Alamos Scientific Lab., N. Mex.
THE METALLOGRAPHY OF CERTAIN HOT PRESSED CARBIDES POSSESSING HIGH MELTING POINTS. Thomas I. Jones. p.32-45 of TECHNICAL PAPERS OF THE ELEVENTH METALLOGRAPHIC GROUP MEETING HELD AT BRIDGEPORT BRASS COMPANY, NOVEMBER 7 AND 8, 1956. 14p.

The metallography of hot-pressed carbides such as TiC, ZrC, HfC, VC, NbC, TaC, Cr_2C_2, Mo_2C, WC, UC, and UC_2 is examined. Sample preparation is described, and a discussion accompanied by plates showing microstructure is presented for each compound. (J.R.D.)

16234 TID-7567(Pt.1)(p.46-61)
Oak Ridge National Lab., Tenn.
FAILURES OF TITANIUM COMPONENTS BY RAPID OXIDATION. T. M. Kegley, Jr. p.46-61 of TECH-

NICAL PAPERS OF THE ELEVENTH METALLOGRAPHIC GROUP MEETING HELD AT BRIDGEPORT BRASS COMPANY, NOVEMBER 7 AND 8, 1956. 16p.

Metallographic aspects of an investigation concerning failures of Ti reactor components are discussed. An impeller of RC-70 Ti, a valve trim of 6 Al—4V Ti alloy, and a valve trim of 4 Al—4 Mn Ti alloy were included in the investigation. The impeller and the 6 Al—4V component failed in oxygenated uranyl sulfate solutions, while the 4 Al—4 Mn component failure occurred in oxygenated trisodium phosphate solution. The failures involved a rapid oxidation of Ti components which had previously operated satisfactorily. Photographs and micro-sections are included, and speculations concerning the reasons for failure are given. (J.R.D.)

16235 TID-7567(Pt.1)(p.62-75)
Oak Ridge National Lab., Tenn.
ISOTHERMAL HEAT TREATMENTS OF HASTELLOY B. R. J. Gray and J. R. Riddle. p.62-75 of TECHNICAL PAPERS OF THE ELEVENTH METALLOGRAPHIC GROUP MEETING HELD AT BRIDGEPORT BRASS COMPANY, NOVEMBER 7 AND 8, 1956. 14p.

Isothermal treatments of Hastelloy B at temperatures of 1300 to 1800°F and treatment times of 100 to 1600 hr are reported. The investigation revealed that Hastelloy B is an age-hardening alloy between 1300 and 1500°F. It is noted that this alloy should not be subject to impact stresses between 1100 and 1500°F. A chart is included which shows the various structures and their hardness as well as the etching procedure. Also included are plates which show microstructure and a Mo—Ni phase diagram. (J.R.D.)

16236 TID-7567(Pt.1)(p.76-80)
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
COMMENTS ON ELECTROLYTIC POLISHING AND ETCHING OF THORIUM AND THORIUM—URANIUM ALLOYS. C. Gordon Hoffman. p.76-80 of TECHNICAL PAPERS OF THE ELEVENTH METALLOGRAPHIC GROUP MEETING HELD AT BRIDGEPORT BRASS COMPANY, NOVEMBER 7 AND 8, 1956. 5p.

A technique is presented for determining the distribution of U in dilute alloys of Th—U to be used as reactor fuels. The technique eliminates straining, which was a drawback found in published methods, and results in good detail as to microstructure. It is noted that the program is in the preliminary stage. (J.R.D.)

16237 TID-7567(Pt.1)(p.81-98)
Los Alamos Scientific Lab., N. Mex.
ISOTHERMAL TRANSFORMATION STUDIES ON URANIUM—MOLYBDENUM ALLOYS. E. G. Zukas. p.81-98 of TECHNICAL PAPERS OF THE ELEVENTH METALLOGRAPHIC GROUP MEETING HELD AT BRIDGEPORT BRASS COMPANY, NOVEMBER 7 AND 8, 1956. 18p.

The transformation kinetics of 0.5 and 1.0 wt.% Mo—U alloys were investigated. Metallography was used as a tool in determining transformation boundaries for the U—0.5 wt.% Mo alloy and in determining M_s temperature. X-ray-diffraction and other types of measurements were used to supplement metallography in positive identification of phases present. An isothermal diagram for the U—1 wt.% Mo alloy was constructed mainly on the basis of x-ray identification. Isothermal diagrams are included as well as plates illustrating microstructure. (J.R.D.)

16238 TID-7567(Pt.1)(p.99-107)
Battelle Memorial Inst., Columbus, Ohio.
POLARIZED-LIGHT GRAIN-SIZE STUDIES OF SOME URANIUM ALLOYS. R. F. Dickerson, A. A. Bauer, and D. M. Cheney. p.99-107 of TECHNICAL PAPERS OF THE ELEVENTH METALLOGRAPHIC GROUP MEETING HELD AT BRIDGEPORT BRASS COMPANY, NOVEMBER 7 AND 8, 1956. 9p.

Polarized light techniques were successfully used to study alpha U grain sizes in U containing moderately high alloy additions. These techniques were found to be effective in revealing grain sizes which are markedly different in many cases from those indicated during bright-field studies. It is suggested that these techniques be included in the methods for metallographic evaluation of U alloys. (J.R.D.)

16239 WADC-TR-58-600
New York. State Univ. Coll. of Ceramics, Alfred.
METAL-CERAMIC LAMINATES. Period Covered: August 1, 1956 to July 31, 1957 and November 1, 1957 to October 31, 1958. R. K. Francis, R. Brown, E. P. McNamara, and J. R. Tinklepaugh. 77p. Project and task title: HIGH TEMPERATURE AND HIGH STRESS CHARACTERISTICS OF CERAMICS AND CERMETS. Contract AF33(616)-3798. (AD-205549; PB-151664). $2.00(OTS).

Forsterite—stainless steel 430, molybdenum—alumina, and Kovar—alumina laminates were fabricated employing brazing techniques. Laminates of molybdenum and a 40% alumina—60% mullite ceramic were hot pressed. Thermal expansion studies were made to facilitate the choice of laminate components. Crack free laminates were hot pressed from ceramic and metal materials of which the ceramic possessed the lower thermal expansion. In laminates having a ceramic material with a thermal expansion greater than the metal, cracking occurred. Thermal conductivity studies were conducted on a forsterite-stainless steel 430 laminate series fabricated by brazing techniques. The measured conductivities of the laminates perpendicular to the laminae were seven to fourteen percent lower than calculated results; the measured conductivities parallel to the laminae were five to fifteen percent higher than the calculated results. (auth)

16240 WAPD-FE-1112
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
EVALUATION OF PRE-SINTERING AND SINTERING TREATMENTS WITH RESPECT TO DENSITIES, CORROSION BEHAVIOR, AND WATER ABSORPTION OF UO_2 COMPACTS. H. R. Hoge and B. E. Schaner. [1956]. Decl. Aug. 25, 1958. $1.80(ph), $1.80(mf) OTS.

The effect of presintering on the sintered density of UO_2 compacts, the effects of sintering on the density, corrosion behavior of presintered and sintered compacts, and the tests for water absorption of UO_2 compacts are evaluated. (J.E.D.)

16241 WAPD-NCE-6827
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
COST STUDY AND EVALUATION PROGRAM FOR DIRECT MELTED HAFNIUM SPONGE. Dec. 1957. 7p. $1.80(ph), $1.80(mf) OTS.

Attached to this report is a letter of transmittal (WAPD-NCE-6850), by J. S. Theilacker, dated Dec. 6, 1957. 2p.

An evaluation of a program for production of direct melted Hf sponge is presented. Cost comparisons for Hf strip produced from crystal bar ingots and direct melted sponge ingots are given. Also, the status of the work program being carried out on direct melted Hf material is summarized, and an estimate of the minimum work necessary to complete the evaluation of direct melted material is presented. (J.R.D.)

16242 AEC-tr-3722
THE SYSTEM ALUMINUM—THORIUM. Ad. Leber. Translated for Atomics International from Z. anorg. u allgem. Chem. 166, 16-26(1927). 12p. \$3.30(ph), \$2.40(mf) JCL.

The preparation, analysis, thermal properties, structure, and phase studies are presented for Al—Th alloys. (W.L.H.)

16243 JPRS-TR-L-571-N
EXPERIMENTAL RESEARCH ON SOME ASPECTS OF STRUCTURAL CREEP THEORY. V. S. Ivanova and L. K. Gordiyenko. Translated from Metalloved. i Obrabotka Metal., No. 6, 2-6(1958). 7p. \$0.50(OTS).

Laws governing variations of electrical conductivity and the microhardness of heat-resistant alloys during various stages of creep tests are described in terms of structural creep theory. Data obtained confirm the theory. (J.R.D.)

16244
STUDY BY THERMAL ANALYSIS OF ALLOTROPIC TRANSFORMATIONS OF PLUTONIUM. R. Pascard (Commissariat à l'Énergie Atomique, Paris). Acta Met. 7, 305-18(1959) May. (In French)

The successive transformations, including fusion, of metallic plutonium were studied by differential thermal analysis. Heating and cooling curves are given. Comparison with metallic standards of known heats of fusion give a first set of heats of transformation with a precision of about 20%. (auth)

16245
MAKING VISIBLE THE DISPLACEMENTS AT THE SUBGRAIN BOUNDARIES OF Fe—Cr ALLOYS BY MEANS OF ION BOMBARDMENT. Alois Mašín (Research Inst. of Commerce, Prague) and Vladimír Havel (Research Inst. of Metallurgy of Iron, Prague). Acta Phys. Acad. Sci. Hung. 9, 471-4(1959). (In German)

The displacements at the subgrain boundaries of a hardened Fe—Cr alloy were investigated with ion bombardment. The iron alloy used had the composition 24% Cr, 0.14% C, 0.65% Si, and 0.04% Mn. The sample, in the form of a cylinder, was hardened in water at a temperature of 1100°C. The ion bombardment, made at a voltage of 1700 to 1900 v and a current intensity of 3 mamp, lasted for 80 to 130 min. The results showed that the displacements were visible only in the range where there were no separation of large carbide constituents, although displacements must exist in the vicinity of these constituents. The possible reasons for these results are discussed. (J.S.R.)

16246
COMPARISON OF RESULTS OF RESILIENCE AND DRAWING EXPERIMENTS RELATIVE TO IRON AGED AFTER DEFORMATION. Régina Pankowski-Fern and Georges A. Homès. Compt. rend. 248, 3167-9(1959) June 1. (In French)

Data from experiments on puddled iron are given and discussed. Curves of resilience versus temperature and elongation versus force are presented from which it is concluded that strain-age hardening and strain-age embrittlement are separate phenomena occurring consecutively. (T.R.H.)

16247
CORRELATION OF THE DIRECTION OF PREVIOUS DEFORMATION AND THE REAPPEARANCE OF FAULTS AT ELASTIC LIMIT IN DRAWING CURVES OF IRON AGED AFTER DEFORMATION. Régina Pankowski-Fern and Georges A. Homès (Université libre, Brussels and Faculté Polytechnique, Mons, Belgium). Compt. rend. 248, 3304-6(1959) June 8. (In French)

Experiments are described which seek to confirm the dependence on previous deformation of the phenomenon of reappearance of "steps" in the elongation vs. force curves of unworked soft iron and steel after aging. The results are interpreted thus: each cubic-centered crystal has 48 possible slip systems [the (110), (112), and (123) planes and the (111) directions]. In each system there are several planes containing sources of dislocations which can become active with the proper inducement. When deformation takes place there are a few active slip systems in each grain. The sources found in the corresponding slip planes become active and produce a large number of dislocations which encounter various obstacles and cause dislocations to pile up. (T.R.H.)

16248
IRRADIATION OF HAYNES-25 AND INCONEL-X COMPRESSION SPRINGS IN HIGH-TEMPERATURE HIGH-PRESSURE WATER. R. L. Mehan (General Electric Co., Schenectady, N. Y.). J. Basic Eng. 81, 226-32 (1959) June.

Irradiation tests were performed on Haynes Stellite Alloy 25 and Inconel-X springs irradiated in the compressed condition in an in-pile high-temperature water loop. The loop was operated at 560 to 600°F and the springs of both materials received integrated fluxes of 5.9×10^{18} and 4.2×10^{19} mvt fast, respectively. Postirradiation testing and examinations revealed no serious deleterious effects resulting from these exposures. It was found the spring constant increased 5 to 8% after exposure and the free length decreased 2 to 3%. (auth)

16249
NEW DATA ON THE STRUCTURE OF $BiIn_2$ AND THE POSSIBLE STRUCTURE OF $TlBi_{1.27 \to 1.59}$, $NaHg_2$, UHg_2, UZr_2 AND TiU_2. Ye. S. Makarov. Kristallografiya 3, No. 1, 5-9(1958).

The crystal structure of $BiIn_2$, $TlBi_{1.27 \to 1.59}$, $NaHg_2$, UHg_2, UZr_2, and TiU_2 was studied by x-ray diffraction of their powders. The results showed that $BiIn_2$ has a structure of the Ni_2In type with the lattice constants $a = 5.496 \pm 0.001$, $c = 6.579 \pm 0.001$, and $c/a = 1.197$. It is suggested that the other metals studied have an analogous structure. $BiIn_2$ differs from other compounds of the Ni_2In type by having a lower axial ratio and by the exclusion of a transition metal. The axial ratios for the other compounds studied were found to be 0.59 for TiU_2, 0.61 for UZr_2, 0.64 for UHg_2, and 0.64 for $NaHg_2$. (J.S.R.)

16250
ELECTRON DIFFRACTION STUDY OF THE STRUCTURE OF LIQUID METALS AND ALLOYS. A. I. Bublik and A. G. Buntar'. Kristallografiya 3, No. 1, 32-42 (1958).

The structure of liquid metals and alloys was investigated by electron diffraction. The preparation of unbacked liquid films with a thickness of 10^{-5} to 10^{-6}

cm and the design of the combination specimen holder and heater are described. Liquid Bi, Al, Sn, In, Bi–Sn, Al–Sn, and Al–In were studied. The results show that liquid metals have the same short-distance order as the crystalline state at the melting point. In the case of metals with dense packing, the coördination number decreases with increasing temperature, but in the case of loose packing the number increases. At high temperatures the distribution density in all liquid metals approaches a smooth curve. Thin films of the liquid alloys, at temperatures close to the crystallization temperature, consist of regions enriched with one of the components. The character of the packing in these uniform regions is very similar to the packing in the corresponding pure liquid metals. (J.S.R.)

16251

RADIOGRAPHY, MICROSTRUCTURE AND MECHANICAL PROPERTIES OF CAST MAGNESIUM–THORIUM–ZIRCONIUM ALLOY HK 31A. T. R. Bergstrom and R. G. Bassett (Boeing Airplane Co., Seattle). Modern Castings 35, No. 4, 79-87(1959) Apr.

Radiographs of cast HK31A magnesium parts exhibit sweeping dark lines, light areas of both circular and angular outline, light areas similar in shape to shrinkage cracks and mottled or banded areas. These indications are excellent evidence of macrosegregation in the castings. An evaluation of the effect of this segregation on the mechanical properties of the cast material was essential to continued use of the cast parts. Several castings were selected on the basis of x-ray indications to be cut into tensile specimens representative of the segregation conditions. These specimens were tensile tested at room temperature and at 500°F. Autoradiographs, radiographs, micrographs, and spectrographs were made of the specimens to investigate variations in composition and associated effects. It was determined that the x-ray indications were caused by segregation, and that the segregation had a definite effect on the microstructure. Severe segregation was found to lower mechanical properties. Regions deficient in alloying elements had reduced elevated temperature mechanical properties, but had normal room temperature properties. Areas of high alloying element content were found to have reduced mechanical properties at both room and elevated temperature. Radiographic standards were established on the basis of the evaluation. (auth)

16252

THE FUTURE OF CERAMICS AS NUCLEAR FUEL. 1. WHAT ARE CERAMICS? N. C. Moore and J. B. Huffadine (Caswell Research Labs., The Plessey Co., Ltd.). Nuclear Power 4, No. 37, 86-9(1959) May.

An introduction to ceramics in general is given. Data available on the materials being developed to replace metal fuels are reviewed. (A.C.)

16253

THE FUTURE OF CERAMICS AS NUCLEAR FUEL. 2. DEVELOPMENT OF THE NEW FUELS. Peter Murray (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Power 4, No. 37, 89-94(1959) May.

Data on materials being developed to replace metal fuels are reviewed. Ceramics with nuclear potential such as uranium dioxide, uranium monocarbide, and dispersed fuels are discussed. (A.C.)

16254

PLUTONIUM METALLURGY IN RUSSIA. M. B. Waldron (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Power 4, No. 37, 111-12(1959) May.

The record of the Moscow conference showed excellent work had been done in plutonium metallurgy, which in most cases paralleled U. S. and U. K. achievements. The work was done by refined techniques using samples measured in milligrams or even micrograms. It appears that micro-metallurgical techniques enabled them to side-step limitations normally caused by extreme radiative toxicity of the material. The Russians reported work on the magnetic properties of plutonium alloys and intermetallic compounds. (A.C.)

16255

SOLUBILITY OF THORIUM DIHYDRIDE IN THORIUM METAL. D. T. Peterson and D. G. Westlake (Iowa State Coll., Ames). Trans. Met. Soc. AIME 215, 444-7(1959) June.

The saturation solubility of thorium dihydride in thorium was studied by saturation of samples and subsequent analysis. The solubility increased from about 1 at. % at 300°C to above 20 at. % at 800°C. Over this temperature range the log of the solubility was a linear function of the reciprocal absolute temperature for thorium of good purity. The heat of solution of thorium dihydride was found to be 7.9 kcal per atom of hydrogen in crystal bar thorium and 6.6 kcal per atom of hydrogen in Ames thorium. (auth)

16256

TWIN ACCOMMODATION IN Au Cd β' ALLOYS. Howard K. Birnbaum (Univ. of Chicago). Trans. Met. Soc. AIME 215, 508(1959) June.

16257

ELECTRIC CONDUCTIVITY OF GERMANIUM IN STRONG ELECTRIC FIELDS AT LOW TEMPERATURES. E. I. Abaulina-Zavaritskaya (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1342-50 (1959) May. (In Russian)

The electric properties of germanium single crystals containing Sb, Bi, and Zn impurities were studied at temperatures between 2 and 10°K. In strong electric fields the electrical conductivity of germanium is characterized by the presence of three regions, a feature of the last one (the so-called breakdown region) being a sharp increase of the electrical conductivity. The breakdown effect is related to the development of the cascade in the conduction band and is independent of the conduction mechanism of germanium at low temperatures. The product of E_{br} and the mobility μ is a function of J/kT where J is the ionization energy of the impurity in germanium. The effect of various factors (temperature, magnetic field) on E_{br} is mainly due to their influence on the carrier mobility. The dependence of E_{br} and resistance on the magnetic field are found to be similar. (auth)

16258

MAGNETIC AND RESONANCE PROPERTIES OF YTTRIUM FERRITE-GARNETS AFTER Fe^{3+} ION REPLACEMENT BY Cr^{+} AND Al^{3+}. K. P. Belov, M. A. Zaitseva, and L. A. Malevskaya (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1602-3(1959) May. (In Russian)

Experiments were conducted for determining the effects of Al^{3+} and Cr^{3+} replacement of Fe^{3+} on the magnetic and resonance properties of stoichiometric $3Y_2O_2 \cdot 5Fe_2O_3$ ferrite garnets. The absorption line dependence on the content of Al^{3+} and Cr^{3+} was plotted. With the increase of Cr^{3+} content the g factor rises from 2.150 ± 0.005 (for $3Y_2O_3 \cdot 5Fe_2O_3$) to 2.200 ± 0.005 (for $3Y_2O_3 \cdot 4Fe_2O_3 \cdot Cr_2O_3$), while with the increase of Al^{3+} the g factor drops to 2.030 ± 0.005 (for $3Y_2O_3 \cdot 4Fe_2O_3 \cdot Al_2O_3$). Comparisons of ΔH, σ_0, and θ curves indicate that the magnitude ΔH is in direct relation to the magnitudes σ_0 and θ. (R.V.J.)

16259

SHEATHED ANNULAR BODIES. L. M. Wyatt and U. K. Atomic Energy Authority. British Patent 802,998. Nuclear Eng. 4, 284(1959) June.

Conventional fuel element assemblies designed for fuel available in tubular form provide for the inner and outer sheath to be joined and sealed by end rings, welded to both sheaths. In order to reduce the number of welds required to seal the elements it is proposed to employ sheaths flanged at one end, the inner sheath to have an outwardly directed flange and the outer sheath an inwardly directed flange. The sheaths are assembled with their flanges at opposite ends. This reduces the number of welds required to two. Where uranium enriched in U^{235} is used as fuel, stainless steel is recommended as material for the sheaths.

16260

TERNARY ALLOYS OF URANIUM, COLUMBIUM AND ZIRCONIUM. F. G. Foote. British Patent 803,118. Nuclear Eng. 4, 284(1959) June.

Uranium metal cast in the high temperature gamma phase (1,000°C) has greater resistance to corrosion by oxidation than in any other phase. This is important when using ternary alloys of uranium as neutron-reflecting materials in a fast neutron pile. Uranium metal becomes stabilized in the gamma phase when closely alloyed with minor amounts of columbium and zirconium in combination (2 to 8%).

16261

PLUTONIUM ALLOYS. William Chynoweth (to U. S. Atomic Energy Commission). U. S. Patent 2,890,954. June 16, 1959.

The preparation of low-melting-point plutonium alloys is described. In a MgO crucible Pu is placed on top of the lighter alloying metal (Fe, Co, or Ni) and the temperature raised to 1000 or 1200°C. Upon cooling, the alloy slug is broken out of the crucible. With 14 at. % Ni the m.p. is 465°C; with 9.5 at. % Fe the m.p. is 410°C; and with 12.0 at. % Co the m.p. is 405°C. (T.R.H.)

PARTICLE ACCELERATORS AND HIGH-VOLTAGE MACHINES

16262 MURA-452

Midwestern Universities Research Assn., Madison, Wis. CONCERNING THE $\nu/N \rightarrow 1/3$ RESONANCE. I. APPLICATION OF A VARIATIONAL PROCEDURE AND OF THE MOSER METHOD TO THE EQUATION $d^2v/dt^2 + (2\nu/N)^2 v + \frac{1}{2} (\sin 2t) v^2 = 0$. L. Jackson Laslett. Apr. 13, 1959. 44p. Contract AT(11-1)-384. $1.25 (OTS).

As an introduction to certain non-linear dynamical problems in which the $\frac{1}{3}$-resonance plays a dominant role, the stability boundary for the equation

$$\frac{d^2v}{dt^2} + \left(\frac{2\nu}{N}\right)^2 v + 1/2 \ (\sin 2\ t)\ v^2 = 0$$

was studied analytically and by digital computation. Use of a relatively simple trial function in a variational procedure or with harmonic balance is shown to lead to simultaneous algebraic equations, for the coefficients in the trial function, whose solution affords a good estimate of the unstable fixed points. Application of the Moser method of solution is also carried through in detail, to include terms of the order $(\nu/N - \frac{1}{3})^2$, and the results compared with computer data for various values of ν/N. (auth)

16263 MURA-459

Midwestern Universities Research Assn., Madison. CONCERNING THE $\nu/N \rightarrow 1/3$ RESONANCE. II. APPLICATION OF A VARIATIONAL PROCEDURE AND OF THE MOSER METHOD TO THE EQUATION $d^2v/dt^2 + (2\nu/N)^2 v + 1/2 \left[\sum_{m=1} b_m \sin 2\ mt\right] v^2 = 0$. L. Jackson Laslett. May 20, 1959. 23p. Contract AT(11-1)-384. $0.75(OTS).

As a continuation of an earlier report pertaining to the $\nu/N \rightarrow \frac{1}{3}$ resonance, the stability boundary for the equation

$$\frac{d^2v}{dt^2} + \left(\frac{2\nu}{N}\right)^2 v + 1/2 \left[\sum_{m=1} b_m \ \sin 2\ mt\right] v^2 = 0$$

was studied analytically and (for $b_1 = 1$, $b_3 = \frac{3}{4}$, $b_5 = \frac{1}{2}$) by digital computation. A relatively simple trial function,

$$v = \sum_{m=1} \Big[A_m \ \sin\ (2\ m - \tfrac{4}{3})\ t + B_m \ \sin 2\ m\ t + C_m \ \sin\ (2\ m + \tfrac{4}{3}) t\Big],$$

is employed in a variational procedure or with harmonic balance to obtain an estimate of the unstable equilibrium (periodic) solution and associated fixed points. Application of the Moser method of solution is also carried through, to include terms of order $(\nu/N - \frac{1}{3})^2$. The results are compared with computational data for $\nu/N = 0.3267$, 0.33, 0.3367, and 0.34. (auth)

16264 MURA-461

Midwestern Universities Research Assn., Madison. CONCERNING THE $\nu/N \rightarrow 1/3$ RESONANCE. III. USE OF THE MOSER METHOD TO ESTIMATE THE ROTATION NUMBER, AS A FUNCTION OF AMPLITUDE, FOR THE EQUATION $d^2v/dt^2 + (2\nu/N)^2 v + \frac{1}{2} (\sin 2t) v^2 = 0$. L. Jackson Laslett. May 28, 1959. 18p. Contract AT(11-1)-384. $0.50(OTS).

The Moser method of analysis, as applied through terms of order $(\nu/N - \frac{1}{3})^2$ in an earlier report, is employed to determine the variation of rotation number (or "tune") with amplitude for solutions of the non-linear differential equation given in the title. The result is given in terms of a complete elliptic integral of the first kind, with a modulus determined by the roots of a quartic equation. The rotation number is thus calculable in terms of an amplitude characterized by the value of the Moser t-independent Hamiltonian, and this in turn may be related to some desired salient dimension of the phase curve of interest. This result, although by no means as convenient for hand calculation as the handy formulas sometimes employed for this purpose, is found to give results in very good agreement with numerical computations for a problem in which the small-amplitude frequency corresponds to $\nu/N = 0.3$. As is typical, the rotation number in this example departs initially from its small-amplitude value (0.3) by an amount proportional to the square of the oscillation amplitude and only near the stability limit undergoes a rapid variation to attain the value $\frac{1}{3}$. The area enclosed by the phase curves, most specifically by the separatrix, is also briefly examined. (auth)

16265 NP-7703
Deutsches Electronen-Synchrotron, Hamburg.
DESCRIPTION OF MAGNETIC DEBUNCHER FOR ELECTRON LINACS. Uwe Timm. Oct. 19, 1957. 8p.

Allan J. Lichtenberg has proposed that it is possible to reduce the energy spread of the output of a linear accelerator by introducing an energy-dependent phase spread and applying a reverse voltage to the particles. The exact shape a static magnetic field must have in order to introduce that phase spread is examined. The way in which the reverse voltage may be applied and tolerances for a debuncher are discussed. (A.C.)

16266 UCRL-8050(Add.)
California. Univ., Berkeley. Lawrence Radiation Lab.
LIST OF PARTICLE-ACCELERATOR INSTALLATIONS: ADDENDA AND ERRATA. Gerald A. Behman. Jan. 20, 1959. 9p. Contract W-7405-eng-48. $0.50 (OTS).

A list of particle-accelerator installations, giving location, type, dimensions, particles accelerated, and energy, is presented. (A.C.)

16267 AEC-tr-3718
REVIEWS OF NUCLEAR PARTICLE ACCELERATORS. V. I. Veksler. Translated by A. L. Monks (Oak Ridge National Lab.) from Uspekhi Fiz. Nauk 66, 99-110 (1958). 21p. $4.80(ph), $2.70(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 3929.

16268
STOCHASTIC ACCELERATION IN A 5-Mev CYCLOTRON. Robert Keller, Louis Dick, and Maria Fidecaro. Compt. rend. 248, 3154-6(1959) June 1. (In French)

A cyclotron is described which produces a 5-Mev proton beam and an internal beam of the order of μamps. It is similar to a synchrocyclotron. The magnetic field decreases 8% from the center to the extraction radius. The unique D-shaped electrode is supplied by a h-f generator which, contrary to that of the synchrocyclotron, produces a randomly varying voltage. A Fourier analysis reveals a continuous spectrum from 21 to 23 MHz; the Fourier components have no phase relations between them. The stochastic principle is discussed, and it is pointed out that this type of cyclotron offers an intensity 10 times that of the synchrocyclotron. It is easier to construct than a fixed frequency cyclotron and has the additional advantage over a synchrocyclotron of having a continuous beam. (T.R.H.)

16269
THE ANGULAR DISTRIBUTION OF RADIATION FROM A BETATRON AT 15 Mev. M. D. Lavrov. Izvest. Vysshikh Ucheb. Zavedenii Fiz. No. 5, 70-2(1958).

Systematic measurements of the maximum energy and the angular distribution of gamma rays in the horizontal plane were made for the 15-Mev betatron of the Tomsk Polytechnical Institute. The maximum energy is between 12.3 and 14.2 Mev. The maximum of the angular distribution of the hard gamma rays is displaced 10^0 with respect to the zero position. The measurements confirm the existence of two maxima in the total radiation. The maximum in the positive direction coincides with the hard gamma-ray maximum. The negative maximum coincides with the theoretical curve predicted for 2- to 4-Mev radiation. When an injector is changed, the angular distribution of the radiation alters greatly. The results of such changes are graphed. (J.S.R.)

16270
CYCLOTRON RADIATION STILL WORRISOME. Nucleonics 17, No. 7, 101(1959) July.

Radiation from the circular orbits of electrons in plasma devices is still regarded as a potential source of considerable power loss from thermonuclear devices. The loss mechanism arises because the centripetal acceleration of spiraling electric charges necessarily causes them to radiate in the microwave region. Deuterium ions, possessing a greater mass, move slowly and their emission of electromagnetic energy is insignificant. The electrons move with relativistic velocities, and the relativistic effects of their motion might result in so serious a power loss as to seriously circumscribe the future of controlled thermonuclear research. If cyclotron radiation should prove serious, all magnetically contained fusion devices would be affected. (A.C.)

16271
PERIODIC FOCUSING OF HIGH CURRENT ELECTRON BEAMS. Ho Kuo-chu (Nankai Univ.). Wu Li Hsüeh Pao 14, 376-92(1958) Sept. (In Chinese)

The focusing of high current electron beams by means of several different systems of periodic electric and magnetic fields has been studied theoretically. One of these periodic electron optical systems studied, i.e., a periodic electric field produced by a series of annular disks held at alternately higher and lower potentials, has also been investigated experimentally in an electrolytic tank. It is found that if the distance between the disks or half period of the field is long (i.e., two or three times longer than the diameter of the apertures at the center of the disks), the potential on the axis may be expressed by a saw-toothed function. Under this condition, the equation for describing the electron beam profile may be solved analytically. The conditions which must be satisfied to give periodic focusing have been obtained. However, if the distance between the disks is short and comparable with the diameter of the aperture, the potential on the axis should be expressed by a cosine function. Under such a condition, the equation for describing the electron beam profile becomes a complicated non-linear differential equation. This non-linear differential equation has been treated in earlier research and was able to obtain its first order approximate solution. In order to get higher order approximations, a perturbation method may be used. This perturbation method has also been applied to treat other periodic electric and magnetic fields, such as axially symmetric magnetic fields, quadrupole electric and magnetic fields. Higher order periodic approximate solutions, as well as the required conditions to give periodic focusing, have been obtained for these fields. It can be shown by numerical examples that for periodic focusing of high current electron beams higher order approximation should be included. (auth)

PHYSICS AND MATHEMATICS

General

16272 A/CONF.15/P/1154
DOSAGES QUANTITATIFS PAR RESONANCE MAG-

NETIQUE NUCLEAIRE. (Quantitative Determination by Nuclear Magnetic Resonance). Ionel Solomon (Commissariat à l'Énergie Atomique, Paris). 3p.

A method for isotopic determination was studied and applied to the measurement of the absolute concentration of a heavy water standard containing approximately 99.8% D_2O. By studying the effect of experimental parameters (line width, intensity to the r-f field, and modulation amplitude), it was possible to find a region which minimizes the effect of these parameters and where the signal-to-noise ratio is a maximum. The result was a method with a precision and a reproducibility several times better than previously obtained. There was an absolute error smaller than 5×10^{-6} on the D_2O concentration. (J.S.R.)

16273 AECU-4179
Universidad Mayor de "San Andres," La Paz, Bolivia. Laboratorio de Física Cosmica de Chacaltaya and Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas.
SIDEREAL ANISOTROPY OF HIGH ENERGY COSMIC RAYS NEAR THE EQUATOR. I. Escobar, V. N. Nerurkar, and R. Weil. 1958. 17p. (Notas de Física Vol. IV, No. 21). $3.30 (ph), $2.40 (mf) OTS.

An experiment detecting extensive air showers responding to primary energies greater than 10^{14} ev is being conducted at Chacaltaya (elevation 5210 meters; geographic latitude 16°S) with coincidences between counter trays separated at least by 20 meters. Some evidence of the sidereal anisotropy of the order of 1% with the time of maximum at 1600 LST is found although the variation cannot be discussed with the absorption curve of the extensive air showers. (auth)

16274 AECU-4199
Illinois. Univ., Urbana. Electrical Engineering Research Lab.
RESEARCH AND INVESTIGATION LEADING TO METHODS OF GENERATING AND DETECTING RADIATION IN THE 100 TO 1000 MICRON WAVELENGTH RANGE OF THE SPECTRUM. Quarterly Progress Report No. 12 [for] January 1, 1959 to March 1, 1959. P. D. Coleman, J. R. Baird, R. C. Becker, B. W. Hakki, J. J. Stafford, R. J. Strain, and A. W. Swago. Apr. 15, 1959. 79p. Contract AT(11-1)-392. $12.30 (ph), $4.50 (mf) OTS.

Status of the work is described on frequency multiplication in ferrites, gas discharge multiplier, wave propagation in nonlinear scalar media, and detection and measuring techniques. (For preceding period see AECU-4091.) (W.D.M.)

16275 AECU-4241
Illinois. Univ., Urbana. Electrical Engineering Research Lab.
RESEARCH AND INVESTIGATION LEADING TO METHODS OF GENERATING AND DETECTING RADIATION IN THE 100 TO 1000 MICRON RANGE OF THE SPECTRUM. Quarterly Progress Report No. 1 [for] March 1, 1956 to June 1, 1956. P. D. Coleman, R. Kenyon, R. Mieher, M. D. Sirkis, and A. W. Swago. June 15, 1956. 27p. Contract AT(11-1)-392. $4.80 (ph), $2.70 (mf) OTS.

The purpose of the research is twofold: (a) to uncover new principles or techniques from which a source of high pulsed power for the 100 to 1000 micron wavelength range of the spectrum can be developed, and (b) to investigate suitable detecting and measuring techniques for evaluating and using the radiation as a diagnostic tool for physical research. Status of the work on the development of a portable rebatron is summarized. Work on beam coupling schemes and detecting and measuring techniques are described. (W.D.M.)

16276 AECU-4242
Illinois. Univ., Urbana. Electrical Engineering Research Lab.
RESEARCH AND INVESTIGATION LEADING TO METHODS OF GENERATING AND DETECTING RADIATION IN THE 100 TO 1000 MICRON WAVELENGTH RANGE OF THE SPECTRUM. Technical Progress Report No. 3 [for] September 1, 1956 to December 1, 1956. P. D. Coleman, M. D. Sirkis, R. Kenyon, H. Mahrous, R. Pantell, H. Spuhler, W. Steier, and A. W. Swago. Dec. 15, 1956. 53p. Contract AT(11-1)-392. $9.30 (ph), $3.60 (mf) OTS.

Progress on the design and development of a practical, compact, portable rebatron is indicated. Work is described on generation schemes using the million volt, bunched electron beam from the rebatron to produce high pulsed power in the 0.1 to 1 mm wavelength region of the electromagnetic spectrum. Detection and measurement of the produced radiation are discussed. (For preceding period see AECU-3401.) (W.D.M.)

16277 AERE-A/R-2514
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
FURTHER MEASUREMENTS OF THE MAGNETIC FIELD PRODUCED BY RIDGED POLE PIECES. P. F. Smith. Mar. 1958. 44p.

Further measurements have been made of the field distribution arising from straight, parallel ridges of rectangular cross section on the poles of a magnet. The quantities flutter and mean gap are tabulated and graphically summarized for an extensive range of the three geometric parameters and for mean fields between 6 kilogauss and 20 kilogauss. A discussion of extrapolation methods is given, with the aid of theoretical calculations, and comparisons are made with fields produced by sector and spiral ridge configurations. Some independent confirmations of this work are also included. (auth)

16278 AERE-GP/M-197
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
ON THE ADIABATIC SELF-CONSTRICTION OF AN ACCELERATED ELECTRON STREAM. J. D. Lawson. Mar. 1957. 11p.

An analysis is made of the behavior under the influence of a longitudinal electric field of a space charge neutralized electron stream. The energy lost by radiation and collision is neglected, and transverse velocities are assumed to be small compared with the drift velocity. It is found that the build-up of the self magnetic field causes the transverse oscillation of the electrons to be damped, however damping is counteracted to some extent by an outward diffusion due to multiple scattering. The importance of the problem lies in the fact that such a beam represents the transition between a tenuous completely ionized plasma and the steady state radiation cooled beam described by Budker. Whether a suitable plasma can be produced, and the transition made in practice, remains to be seen. (auth)

16279 AERE-GP/M-200

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE RELAXATION TIME FOR THE CONTRACTION OF A RELATIVISTIC SELF-CONSTRICTED ELECTRON BEAM. J. D. Lawson. June 1957. 10p.

The rate of contraction of the beam which occurs when the electron energy is increased above its steady state value was calculated. No attempt to formulate the general problem of the beam behavior under non-steady conditions is made; rather a simple specific calculation which illustrates the physics of the problem and the order of magnitude of the time constants involved is presented. (J.R.D.)

16280 AERE-GP/M-203

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

MEAN KINETIC ENERGY OF IONS IN LOW PRESSURE PLANE SYMMETRIC PLASMAS. E. R. Harrison. Sept. 1957. 5p.

On integrating the Boltzmann equation, an expression is derived for the mean kinetic energy of ions in low-pressure plane symmetric plasmas. It then follows that at the plasma boundary the ions cannot have a mean kinetic energy greater than 1.26 kT, where T is the electron temperature and k is the Boltzmann constant. Furthermore, the ratio of the electron or ion densities at the boundary and at the plane of symmetry cannot be less than 0.28. If it is assumed that the mean kinetic energy at the plasma boundary is close to that given by the Bohm criterion, it is then possible to determine to a similar degree of accuracy additional conditions applying at the boundary. (auth)

16281 AERE-T/R-2786

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE STABILITY OF A PLANE PLASMA SHEET OSCILLATING BETWEEN CONDUCTING WALLS. R. J. Tayler. Mar. 1959. 36p.

A stable plasma can execute regular oscillations in a conducting tube. If its surface is perturbed at the moment it is reflected by the wall, the perturbation will either be smoothed out by the reflection or will become more important on successive reflections. It is shown, for a very simplified problem, that such perturbations can grow at a rate which is comparable with the period of the main oscillation. If this result is true it is an example of a non-linear instability. It is not clear, at the moment, whether the non-linear terms do lead to a true instability or whether they transfer energy from one stable oscillation to another. (auth)

16282 AERE-T/R-2859

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

ADDITIONAL NOTES ON A TWO SPACE DIMENSION MULTIGROUP PROGRAM FOR THE MERCURY COMPUTER. A. Hassitt. Mar. 1959. 34p. $0.70(BIS).

A program is presented which solves the multi-energy group neutron diffusion equations in either xy or rz geometry. A detailed description was given in report AERE T/R 2487. This report gives some additional details. It contains operating instructions, description of recent additions to the program, and an analysis of some of the numerical and coding techniques. (auth)

16283 AFOSR-TN-59-631

Maryland. Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.

SELECTED TOPICS FROM THE THEORY OF GAS FLOW AT HIGH TEMPERATURES. VI. SOME ASPECTS OF PARTICLE INTERACTION IN GASES. J. M. Burgers. June 1959. 41p. Contract AF49(638)-401. (BN-176).

A simplified form of the Boltzmann equation to take account of reactions between particles is discussed. The formal treatment is restricted to spontaneous reactions and binary collisions. An example is given of the general form which the Boltzmann equation obtains. The treatment of collisions between charged particles with the aid of a two-particle distribution function is discussed in detail. A mathematical analysis of plasma oscillations is given. (A.C.)

16284 BNL-513

Brookhaven National Lab., Lemont, Ill.

SOME RELATIVISTIC TWO-BODY KINEMATICS TABLES. L. B. Leipuner. Aug. 1958. 312p. $5.00(OTS).

More than 600 relativistic kinematics tables are included. These tables were originally calculated for use in design and analysis of experiments at the Cosmotron. (A.C.)

16285 CERN-59-23

European Organization for Nuclear Research, Geneva.

THE APPLICATION OF THE "CLUSTER" MODEL TO NUCLEAR PHYSICS. Karl Wildermuth and Th. Kanellopoulos. June 5, 1959. 147p.

It is possible by means of nuclear models to describe in a more or less good approximation the behavior of nuclei in low-energy processes, but the connection between different models is not very clear. The derivation of different models from the interaction forces between nucleons is discussed. A survey is made of various nuclear models including the shell and cluster models and their applications in nuclear physics. (A.C.)

16286 CF-58-9-2

Oak Ridge National Lab., Tenn.

STRESS ANALYSIS OF CYLINDRICAL SHELLS. F. J. Stanek. July 22, 1959. 30p. Contract W-7405-eng-26. $6.30(ph), $3.00(mf) OTS.

The principal formulas and tables of numerical values for the stress analysis of cylindrical shells loaded axisymmetrically are presented. The analysis is based on the classical small-deflection theory. The formulas and the numerical values of all necessary functions are given and are sufficient for a complete analysis of specific cylindrical shells. Derivation of cylindrical-shell formulas is given. (J.E.D.)

16287 CF-58-9-36

Oak Ridge National Lab., Tenn.

FLOW THROUGH SINTERED INCONEL ANNULI. J. L. Wantland, H. W. Hoffman, and R. L. Miller. Sept. 17, 1958. 9p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

The flow-pressure drop characteristics of two sintered Inconel annuli of differing porosities were determined. For the range of flow and pressure level studied, the flow was observed to be laminar and to obey Darcy's law approximately. Specific permeability coefficients were calculated and compared with values for flow through both unconsolidated and consolidated porous media. (auth)

16288 CF-59-4-30
Oak Ridge National Lab., Tenn.
LEACHING OF RAINIER DEBRIS. W. D. Bond and W. E. Clark. Apr. 2, 1959. 7p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

The leaching data show that no appreciable amounts of radioactive contaminants will be released to ground water. Only about 0.5% of the activity was leached from debris crushed to $<53\ \mu$ when agitated for 48 hours with ground water from the Nevada test site. Even under extreme conditions of 6 $\underline{M}$ boiling acids, only about 2% of the activity was leached in 16 hours from samples crushed to 149 to 297 μ. (auth)

16289 CNI-10
Italy. Comitato Nazionale per le Ricerche Nucleari, Milan.
ALPHA-PULSE ANALYSIS BY IONIZATION CHAMBER. G. Bertolini, A. M. Del Turco, and G. Restelli. Apr. 1959. 11p.

Alpha-pulse analysis by gridded ionization chamber shows a standard deviation of about 18 kev for samples of U^{238}, U^{234}, Th^{232}, Th^{230}, and Th^{228}. (auth)

16290 CU-184
Columbia Univ., N. Y. Pupin Cyclotron Lab. and Columbia Univ., N. Y. George B. Pegram Lab.
PROGRESS REPORT FOR OCTOBER, NOVEMBER, DECEMBER 1958 TO THE UNITED STATES ATOMIC ENERGY COMMISSION. W. W. Havens, Jr. 38p. Contract AT-30-1-GEN-72. $6.30(ph), $3.00(mf) OTS.

Neutron resonance levels in As were obtained using self-detection techniques and transmission measurements. The large, flat detector using the $B^{10}(n,\alpha)$ reaction was successfully operated with the NEVIS velocity spectrometer. The differential cross sections for neutrons elastically scattered from He^3 are given for energies of 2.6, 5.0, 8.0, and 17.5 Mev. $He^3(n,p)$ and $He^3(n,d)$ cross sections are also given. Preliminary measurements of neutron total cross sections for Pu^{239} U^{233}, and U^{235} at 0 to 0.1 ev are plotted. A search was made for the double gamma emission predicted in the 0^+-0^+ ground state transition from the 3.35 Mev state of Ca^{40} excited by proton bombardment. An upper limit of 1:1 was placed on the γ-γ/π ratio. A rule was developed for obtaining the relativistic corrections to beta decay spectra from formula for the first forbidden transitions. Measurements of the circular polarization of gamma rays following beta decay were used to determine the longitudinal polarization of electrons from the decay. (For preceding period see CU-178.) (D.E.B.)

16291 ERDE-20/R/58
Gt. Brit. Explosives Research and Development Establishment, Waltham Abbey, Essex, England.
THE THERMAL CONDUCTIVITY OF HEAVY WATER BETWEEN 75°C AND 360°C AT PRESSURES UP TO 300 atm. J. T. A. Burton and H. Ziebland. Jan. 1959. 19p.

The thermal conductivity of heavy water having an isotopic purity of 99.85% was measured with a vertical coaxial cylinder apparatus at pressures between 24 and 294 atm. in the temperature range 75 to 360°C, the latter temperature being eleven degrees below the critical temperature. The pressure range of the experiments included the critical pressure (218 atm.). Identical with the trend exhibited by water, the thermal conductivity of heavy water was found to increase with rising temperature to a shallow maximum near 110°C and to fall with a further rise in temperature. The influence of pressure on thermal conductivity was small, and at 75°C amounted to an increase of about 1% for a pressure rise from 1 to 100 atm. In comparison with natural water, the thermal conductivity of heavy water, in the range investigated, was always lower. According to these tests the ratio k_{H_2O}/k_{D_2O} increased almost linearly from a value of 1.045 at 75°C to a maximum of 1.12 near 250°C and fell steeply with a further rise in temperature, apparently reaching unity near the critical temperature. (auth)

16292 JEN-22
Spain. Junta de Energia Nuclear, Madrid.
AKTIVITAT VON SCHEBENFORMIGEN NEUTRONENSONDE. (Activity of Disk-Shaped Neutron Probes.) M. A. Vigon. 1956. 6p.

The activity of a radioactive disk probe has been calculated as a function of the neutron absorption coefficient μ of the probe substance for various self-absorption coefficients α of the electrons in the probe. The hypothesis $\alpha/\mu \ll 1$ is fulfilled, however, only in the vicinity of a strong resonance absorption region for neutrons in the probe material. Therefore, a more general expression for the activity of disk probes and approximation formulas for some limiting cases are derived. It is shown that the activity, with consideration of the self-absorption of the electron, depends on the orientation of the probe. A consideration of these conditions allows a measurement of the neutron density and the neutron current. (tr-auth)

16293 JPL-PR-20-322
California Inst. of Tech., Pasadena. Jet Propulsion Lab.
HEAT FLUX-RUPTURE LIMITS WITH INTERNAL HEAT GENERATION OF SEVERAL GRAPHITES UP TO 5000° FAHRENHEIT. Progress Report. W. B. Powell and P. F. Massier. June 10, 1957. 42p. Contract DA-04-495-Ord 18. (AD-147917).

The known high-temperature strength and favorable nuclear characteristics of graphite recommend it for consideration in the design of high-temperature, gas-cooled nuclear reactors. A limiting factor in such an application might be thermal stress failure of graphite elements having internal heat generation, due to internal temperature gradients. Prediction of thermal stress requires knowledge of physical properties at high temperature, and this information is not available for many grades of graphite. An apparatus was devised in which graphite specimens could be subjected to thermal stress so that the limiting values of internal heat generation rate could be determined. Graphite specimens $^1/_8$ inch thick, $^3/_4$ inch wide, and 7 inches long were mounted in a passage having blackened water-cooled mild-steel wall. The specimen was heated with an electric current. Pure nitrogen gas was used as a coolant in the passage. Specimens were cut with differing grain orientations from three different grades of graphite. Thermal stress fractures were induced at surface temperatures between 3200 and 5100°F. The maximum heat-generation rate achieved was approximately 200 megawatts per cubic foot, corresponding to a surface heat flux of $5^3/_4$ Btu in.^{2} sec. (auth)

16294 JPL-PR-20-326
California Inst. of Tech., Pasadena. Jet Propulsion Lab.
HIGH-TEMPERATURE TENSILE PROPERTIES OF GRAPHITES. Progress Report. H. E. Martens, L. D. Jaffe, and J. E. Jepson. Sept. 30, 1957. 42p. Contract DA-04-095-Ord 18. (AD-147339).

The tensile properties of six grades of graphite were determined at temperatures of 4000 to 5000°F. The specimens had a gage section which was $\frac{1}{4}$ in. in diameter by 2 in. long; the specimens were heated in helium by an external graphite heater. At 4500°F and above, the material exhibited some plasticity, and load-deformation curves were recorded. A peak in the strength-temperature curve at approximately 4500°F was found. Tensile strengths at 4500°F were, approximately, double those at room temperature. With strain rates of 2.5×10^{-5} to 20×10^{-5} per sec, all grades failed brittlely at 4000°F, with elongations of less than 1%. At 4500°F, elongations up to 5% were obtained, and at 5000°F, up to 20%. The reduction in area was always less than 5%. Elongations greater than 5%, therefore, caused decreases in density. Decreases in density up to 15% were found. These were proportional to the elongation. In both an extruded and a molded grade, the strength was greater and the elongation smaller when measured parallel to the grain. (auth)

16295 K-1375
Oak Ridge Gaseous Diffusion Plant, Tenn.
RANKINE AND ABSORPTION POWER CYCLES—SELECTION OF FLUIDS FOR OPERATION BETWEEN GIVEN TEMPERATURE LEVELS. A. A. Brooks and A. S. Berman. Nov. 20, 1958. 45p. Contract W-7405-eng-26. $7.80(ph), $3.30(mf) OTS.

The complete optimization of a Rankine cycle is discussed, and it is shown that this leads to a Carnot cycle. Equations describing an idealized Rankine cycle and an idealized absorption cycle are derived and show that the efficiency can be expressed as a function of the highest and lowest temperatures available, the average specific heat of the vapor, the heat of evaporation or desorption, and the boiling point elevation. These parameters are coupled into convenient dimensionless parameters $T_c\overline{C_p}'/\Delta H$, T_c/T_2, and T_c^0/T_c. The efficiency of the Rankine cycle is found to decrease monotonically with increasing values of the parameter $T_c\overline{C_p}'/\Delta H$ for given T_c/T_2. The absorption cycle is found to have a maximum efficiency (for given T_c/T_2 and T_c^0/T_c) at some specified value of $T_c\overline{C_p}'/\Delta H$. The efficiences of the Rankine cycle and absorption cycle are compared, and the Rankine cycle is found to be superior except for the case of a superheated exhaust when using a volatile component whose heat of desorption is greater than its heat of evaporation. (auth)

16296 K-1420
Oak Ridge Gaseous Diffusion Plant, Tenn.
A NEW APPARATUS FOR LIQUID PHASE THERMAL DIFFUSION (thesis). Edward Von Halle. June 24, 1959. 363p. Contract W-7405-eng-26. $5.00(OTS).

The design and construction of a thermal diffusion column free of ramification caused by the forgotten effect are reported. The operating characteristics of this column were also investigated. A comparison is made between the separating efficiency of the horizontal thermal diffusion column and that of the thermogravitational column. An extensive compilation of the results obtained by previous investigators of liquid phase thermal diffusion and an annotated bibliography on all phases of thermal diffusion containing 690 references are included. (W.L.H.)

16297 KAPL-2003
Knolls Atomic Power Lab., Schenectady, N. Y.
MONTE CARLO ANALYSIS OF A WATER AGE EXPERIMENT. C. R. Mullin. Jan. 20, 1959. 10p. Contract W-31-109-Eng-52. $0.75(OTS).

An experiment measuring the age in water of neutrons produced by the D(d,n)He^3 reaction was performed by the National Bureau of Standards. A Monte Carlo analysis of the problem gives good agreement with the experimental value. (auth)

16298 KAPL-M-WAN-8(Rev.)
Knolls Atomic Power Lab., Schenectady, N. Y.
NUCLEAR STUDY OF CONTROL POISONS FOR S3G/S4G. W. A. Northrup. Mar. 1959. 16p. Contract W-31-109-Eng-52. $3.30(ph), $2.40(mf) OTS.

A survey was carried out to identify all of those materials which would be acceptable control materials for pressurized water reactors from the nuclear standpoint. Estimates have been made of the quantities required for 19 cruciform-shaped $\frac{3}{16}$ in. thick control rods. A material was considered unacceptable if the $\frac{3}{16}$ in. thick blade was not "black" to thermal neutrons with the material at full density. Acceptability for any particular application would depend on the ability of the material to absorb epithermal as well as thermal neutrons. However, this survey is confined to consideration of thermal neutron absorption only. The loss of blackness due to non-uniform burnup of poison was treated in some detail for boron-containing rods and for europium-gadolinium rods. The minimum acceptable concentration of poison for boron-containing rods is about 0.027 grams B^{10}/cm^2. For europium-containing rods the recommended concentration is 0.46 grams Eu/cm^2 (15 volume percent Eu_2O_3 in $\frac{3}{16}$ in. rod). A number of materials such as hafnium, rhodium, silver, rhenium, and gold are required in large quantities for rod "blackness" and as a result are only slightly affected by non-uniform burnup during operation. These materials are, therefore, desirable from the standpoint of nuclear design simplicity, and the absence of undesirable burnout of the rod tips. (auth)

16299 LA-1624
Los Alamos Scientific Lab., N. Mex.
AVERAGE FISSION CROSS SECTION OF U^{238} FOR FISSION NEUTRONS. R. B. Leachman and H. W. Schmitt. Jan. 1953. Decl. Oct. 31, 1955. 44p. Contract W-7405-eng-36. $7.80(ph), $3.30(mf) OTS.

By means of measurements with a double ionization chamber, the average fission cross section of U^{238} for neutrons from the fission of U^{235} was determined in terms of ν, the average number of neutrons per fission of U^{235}. The number of fissions of U^{238} was measured in one of the ionization chambers while the number of fissions from the fission neutron source of U^{235} was measured in the other chamber. In the nine runs made to determine the cross section, a variety of different methods was used to determine the number of fissions and the mass of U^{238}. The weighted average of these runs gives $\overline{\sigma}_f(28) = (0.756 \pm 0.008)/\nu$ barn or, if the most recent value $\nu = 2.48 \pm 0.03$ is used, $\overline{\sigma}_f(28) = 0.305 \pm 0.005$ barn. (auth)

16300 MND-SR-1673
Martin Co. Nuclear Div., Baltimore.
STRONTIUM 90 POWER PROJECT. Quarterly Progress Report [for] January 15, 1959 through April 15, 1959. Apr. 1959. 90p. $15.30(ph), $5.40(mf) OTS.

The purpose of this program is to determine the feasibility of using Sr^{90} as the heat source in a thermoelectric generator which is to have an unattended life expectancy of up to 10 years under the most extreme environmental conditions. Designs for 100-w generators for land, sea, and undersea applications are being developed. The most suitable compound form of Sr^{90} and the most corrosion resistant alloy for both land and sea applications were selected, and biological shield requirements were determined. The land application design was completed, and fabrication problems of such a unit were analyzed. In selecting the most suitable compound form of Sr^{90}, eight compounds were tested for insolubility, thermal conductivity, fabricability, high compound density, high strontium density, and structural stability. Of these eight, only strontium titanate exhibited the qualities required. The corrosion box for heat element compound evaluation was fitted with a water reservoir system to provide constant volume during long term studies. The heat element fabricating dry box was fitted with rubber glove ports and an automatic air sampling device to assure safe operating conditions for fabricating test pellets containing Sr^{90}. Stable strontium titanate pellets as large as 2⅝ in. in diameter were successfully fabricated. Thermal conductivity of strontium titanate and cermets of this compound are being measured from room temperature to operating temperatures of the proposed generator. (First quarterly progress report was administrative in nature and is not available for public release.) (W.D.M.)

16301 NAA-SR-Memo-946
North American Aviation, Inc., [Downey,] Calif.
DIFFUSION LENGTH MEASUREMENTS IN NON-MULTIPLYING LATTICES. S. W. Kash, F. B. Estabrook, and E. N. Martin. Apr. 5, 1954. Decl. Nov. 6, 1958. 8p. $1.80(ph), $1.80(mf) OTS.

Recent theoretical analyses of exponential measurements on D_2O–U lattices raised the question of the L^2 calculations for heterogeneous lattices. Reinvestigation of the old L^2 measurements revealed that, because of a small epithermal neutron flux entering the D_2O tank, the measured L^2 values were very likely in error. (W.L.H.)

16302 NAA-SR-Memo-1732
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
TWO GROUP LATTICE CALCULATIONS FOR 704. John Cobb. [nd]. 7p. $1.80(ph), $1.80(mf) OTS.

A code for determining the material K_∞ for the OMR plate type cells is described. The code is best suited to lattices of the type characterized by cell symmetry, plate type fuel elements, homogeneous moderator, and a total cell radius which is greater than the fuel box radius. The code is utilized to its best advantage when several small changes within the lattice itself are being investigated. (J.R.D.)

16303 NP-7645
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
NUCLEAR SPIN-LATTICE RELAXATION TIME AND THE ELECTRIC INTERNAL FIELD IN POLAR LIQUIDS. Report No. 73/II. J. W. Hennel. Mar. 1959. 5p.

The intrinsic dielectric relaxation times at different temperatures for water were calculated. The results are discussed, and agreement with Powles' internal field theory is shown. (auth)

16304 NP-7652
Case Inst. of Tech., Cleveland.
PRESSURE VARIATION OF THE ELASTIC CONSTANTS OF SODIUM. Technical Report No. 3. W. B. Daniels. June 1958. 25p. Project NR-017-309. Contract NONR-1141(05).

The pressure variation of the single crystal elastic constants of sodium was measured at room temperature using a modified ultrasonic pulse echo method. The values found for the pressure derivatives of the elastic constants are: $dC_{44}/dP = 1.63$, $dC'/dP = 0.226$, and $dB_s/dP = 3.60$. The notations $C' = (C_{11} - C_{12})/2$ and $B_s = (C_{11} + 2C_{12})/3$ were used. The results are interpreted in terms of Fuchs' theoretical calculation of the Coulomb contribution to the shear stiffnesses of the alkali metals, and indicate that as the metal is compressed, the value of the electronic wave function at the boundaries of the atomic polyhedra increases more rapidly than $\Omega^{-1/2}$, where Ω is the volume of the atomic polyhedron. The volume variation of the value of the wave function of the lowest electronic state at the boundaries of the atomic polyhedra is found to be: $[(d \ln \mu_0 (r_s))/(d \ln \Omega)]_{\Omega = \Omega_0} = -0.27$. (auth)

16305 NP-7693
Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas.
THE DECAY OF Ti^{44}. E. W. Cybulska and L. Marquez. 1959. 10p. (Notas de Física Vol. V, No. 1).

Ti^{44} was studied with scintillation spectrometers, coincidences, and delayed coincidences and was found decayed by electron capture to the second excited state of Sc^{44}. This is followed by a gamma ray of 79 kev and then a gamma ray of 70 kev. The 70 kev state is metastable with a half life of 0.18 μsec. (auth)

16306 NP-7704
Deutsches Electronen-Synchrotron, Hamburg.
SOME KINEMATICS OF INELASTIC HIGH-ENERGY SCATTERING. E. Zimmerman. [nd]. 14p.

Bernstein has assembled useful formulas for the elastic scattering of high energy particles with zero rest energy. However, many collisions of such particles will be inelastic with the production of π-mesons, K-mesons, and strange particles. Formulas for inelastic interactions, which supplement Bernstein's are presented. The assumption that the rest mass of the incident particle (electron) is zero is used here also; the error due to this approximation is negligible in the Bev region. The formulas are exact for gamma rays. (auth)

16307 NRL-5318
Naval Research Lab., Washington, D. C.
A REACTOR CODE FOR THE NAREC. S. Podgor and L. A. Beach. Apr. 10, 1959. 10p.

A few-group, multiregion, one-dimensional reactor code was prepared for the Naval Research Laboratory Electronic Digital Computer (Narec). It applies to slab, cylindrical, and spherical geometries. For any geometry and material composition, the calculation gives (a) the multiplication constant, (b) the spatial flux distribution for each energy group, and (c) the spatial source distribution. Calculations of two critical arrangements of the Naval Research Reactor are described. Comparison of calculated and experimental results indicates that they are within five percent of each other or better. (auth)

16308 NYO-2615
Westinghouse Electric Corp. Research Labs., Pittsburgh.
ULTRAHIGH VACUUM TECHNIQUES. Quarterly Progress Report for February 1, 1959 to March 31, 1959. Research Report 403FF466-R1. May 28, 1959. 25p. Contract AT(30-1)-2176. $4.80(ph), $2.70(mf) OTS.

Data on the use of Teflon for ultrahigh vacuum applications indicate that it may have application in large conductance valves. Tests on a valve having a copper seat 4 in. in diameter, employing a hydraulic mechanism, are reported. New data obtained on non-refrigerated large conductance isolation traps substantiated initial findings. Isolation traps with conductances of about 300 liters per second have isolated ultrahigh vacuum systems at pressures less than 10^{-9} mm Hg for 75 days. Preliminary studies of systems involving hot metallic surfaces and hydrogen gas are reported. (For preceding period see NYO-8705.) (J.R.D.)

16309 NYO-2829
Westinghouse Electric Corp. Research Labs., Pittsburgh.
ON DECISION MODELS FOR NUCLEAR PROCESS CONTROL. Research Report 412FF360-R2. R. M. Durstine. June 17, 1959. 20p. $3.30(ph), $2.40(mf) OTS.

A study was conducted for the purpose of formulating solutions to the inventory control problems associated with operation of a nuclear complex. A description of the presumed nuclear complex is included as well as discussion and construction of a suitable mathematical model and application of the model. Also, specific and miscellaneous questions are discussed. (J.R.D.)

16310 NYO-7548 (Pts. 1 and 2)
Tufts Univ., Medford, Mass.
A RATIONALIZATION OF THE FORMATION OF SALINE AND METALLIC HYDRIDES. Thomas R. P. Gibb, Jr. (Pt. I, May 15, 1958. 71p. and Pt. II, Jan. 19, 1959. 36p.). Contract AT(30-1)-1355 Pt. I, $9.30 (ph), $3.60(mf) OTS and Pt. II, $6.30(ph), $3.00(mf) OTS.

These two parts were issued separately, but are cataloged as a unit.

The previously reported observation that internuclear distances in metallic hydrides are approximately the sum of the cation radius and hydride anion radius (1.29A) is extended, and additional data presented. If it is assumed that the lattice energy of a metallic hydride is similar to that of a salt and if the lattice energy is approximated by a simple equation, then it is shown that the ability of a metal to form a stoichiometric hydride may be rationalized in terms of a partial Born-Haber cycle. Tables of ionic radii, internuclear distances, cohesive energies, and ionization potentials are included. Also, the energetics of the formation of saline and metallic hydrides are rationalized on the basis of more accurate values for the lattice energy. For metallic hydrides the lattice energy is based on a simple model in which hydrogen anions and metal cations of maximum stable charge are held together in a lattice by coulombic forces, frequently supplemented by metal-metal bonding. The directional character of the latter is taken into account, and the contribution of metal-metal bonding to the lattice energy is approximated by a semiempirical calculation. (auth)

16311 NYO-7934
Aeroprojects, Inc., West Chester, Penna.
APPLICATIONS OF ULTRASONIC ENERGY. Progress Report No. 13 Covering Period from December 1, 1958 to January 31, 1959. Feb. 1959. Changed from OFFICIAL USE ONLY May 1, 1959. 31p. Contract AT(30-1)-1836. $4.80(ph), $2.70(mf) OTS.

Investigations of additive aerosols as supplements in the ultrasonic coalescence of KCl were continued, and of the several additives utilized, the antistatic agent G-3300 appeared to be the most effective. Preliminary experiments were also carried out with submicron NaCl aerosol as a simulant for radioactive particulates in calciner off-gases. Greater analytical sensitivity obtainable with NaCl permitted the observation that particulate concentration could be reduced to less than 8 μg/cu ft through ultrasonic coalescence in a single stage. Controlled experiments indicate ultrasonic dissolution rates of thorium in boiling mercury (350°C) to be 14.8 $mg/cm^2/hr$, with 95% confidence limits of 0.8 $mg/cm^2/hr$. This represents a 1000-fold increase over the non-ultrasonic control, and a 2-fold increase over the ultrasonic rate at 150°C reported earlier. Ultrasonic leaching for 21 hours of a simulated cesium-bearing alumina waste was better than 99% effective with a continuous flow treatment of 1 ml/min of 0.01 N HNO_3 using a ratio of waste to liquid of 1:100. Promising results were also obtained at higher power levels (1000 watts) and shorter time periods in batch-type leaching treatment. (For preceding period see NYO-7933.) (auth)

16312 NYO-8678
New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
SPECIAL BLOCK AND LINE ITERATIONS WITH APPLICATIONS TO LAPLACE AND BIHARMONIC DIFFERENCE EQUATIONS. Herbert B. Keller. Jan. 1, 1959. 25p. Contract AT(30-1)-1480. $4.80 (ph), $2.70(mf) OTS.

Special iteration procedures for solving linear systems of a particular form are considered. It is proved that the iterations can always be made convergent, and some results on improving the rate of convergence are given. The application of these methods to Laplace and biharmonic difference equations is studied. In the former case it is found that the present schemes are inferior to some previously proposed methods. However, for the biharmonic case they may be of practical value. (auth)

16313 ORNL-2750
Oak Ridge National Lab., Tenn.
A TABLE OF THREE EXPONENTIAL INTEGRALS. D. K. Trubey. July 2, 1959. 63p. Contract W-7405-eng-26. $1.75(OTS).

A table was prepared to facilitate numerical calculations for some exponential integrals which occur frequently in diffusion and shielding theory. The calculations were performed on the ORACLE using floating point arithmetic. Explanations of the formulas used in table preparation are given along with other information for the user. (J.R.D.)

16314 PR-P-41
Atomic Energy of Canada Ltd. Chalk River, Ont.
PHYSICS DIVISION PROGRESS REPORT [FOR] JANUARY 1, TO MARCH 31, 1959. 83p. (AECL-830). $2.00(AECL).

The installation of the Tandem Accelerator was completed, and it has operated well. Proton beams of about 1 ma were obtained at energies from 2 to 10 Mev. A series of neutron threshold measurements were made as calibration points. Studies were made of gamma yields from proton capture in Al^{27} and B^{11} at 3 to 8 Mev. Inelastic neutron scattering at 14 Mev was studied using targets of Na, Mg, Al, Si, P, S, K, and Ca. A study was made of the frequency-wavelength relationship for elastic waves traveling in single crystals of lead and sodium iodide. Calculations were made to determine unsafe configurations for the "bird cage" storage vessel. Calculations on the oscillator model of the nucleus were continued with the introduction of spin-orbit coupling. The general Wigner-Eisenbud resonance theory was used to develop a method of analysis for the measured neutron cross sections of fissionable nuclei. (For preceding period see PR-P-40.) (D.E.B.)

16315 RDB(Cap)-5181
Gt. Brit. Capenhurst Works, Capenhurst, Ches., England.
THEORY OF VISCOSITY PLATE THRUST BEARING BASED ON CIRCULAR GEOMETRY. L. N. Snell. Oct. 13, 1952. 18p. (IPDC/P-137).

The Whipple Theory of the viscosity plate thrust bearing is based on the assumption that the radius of the plate is large compared with the width of the pumping portion. This condition is not fulfilled in practice, and it was thought that this might be the cause of the observed discrepancy between theory and experiment. A modified theory which takes full account of the circular nature of the plates is presented. It is shown that such a modification will not reduce the discrepancy between theory and experiment. (auth)

16316 SCDC-606(Del.)
Sandia Corp., Albuquerque, N. Mex.
A PROPOSED MODIFICATION OF SCALING LAWS FOR EXPLOSIVE PHENOMENA. Everett F. Cox. Mar. 28, 1956. Decl. with deletions Dec. 14, 1956. 21p. $4.80 (ph), $2.70(mf).

A semi-acoustic theory of blast energy propagation, incorporating Sach's scaling law modified for altitude of observation, gives excellent agreement with experiments providing Hilliar's Similarity Principle is restricted to similar ambient (weather) conditions. (auth)

16317 SCR-83
Sandia Corp., Albuquerque, N. Mex.
POSITIONAL TOLERANCING AT SANDIA CORPORATION. F. F. Eichert and P. A. Nicovich, eds. May 1959. 38p. Contract [AT(29-1)-789]. $1.00(OTS).

For presentation at the Industrial Education Institute Conference on Dimensioning and Tolerancing, Chicago, Illinois, May 1959.

A brief introduction to the Positional Tolerance Method of Dimensioning as employed by Sandia Corporation is presented. The emphasis is placed on the elimination of ambiguities and increase in tolerances provided by this method as compared to the older, bilateral method. (auth)

16318 SCR-87
Sandia Corp., Albuquerque, N. Mex.
DESIGN OF A 5-INCH INTERMITTENT-FLOW HIGH-TEMPERATURE HYPERSONIC WIND TUNNEL. Alan Pope and Randall C. Maydew. May 1959. 36p. $1.00 (OTS).

The design of a 5-inch model of an 18-inch intermittent hypersonic tunnel is discussed. The reasons for selecting an axisymmetric configuration and the particular range of operating conditions for the 18-inch tunnel are outlined. The planned uses of the pilot tunnel are discussed. Particular emphasis is placed on the design of the gas-fired pebble-bed heater, the axisymmetric nozzles, and the pressure control system. The pilot model is designed to operate at $3.0 \leq M \leq 9.0$ at total temperatures up to 3000°R. (auth)

16319 UCRL-8770
California. Univ., Berkeley. Lawrence Radiation Lab.
INVESTIGATION OF WINDOWS AND SHIELDS FOR NEUTRON POINT SOURCES. Harold J. Browne, John A. Kaufmann, and Nelson B. Garden. May 20, 1959. 23p. Contract W-7405-eng-48. $4.80(ph), $2.70(mf) OTS.

For presentation at the Health Physics Conference, Gatlinburg, Tenn., June 18, 1959.

An empirical approach for the evaluation of shielding materials for macrochemical manipulations of spontaneously fissioning heavy elements (curium and californium) has revealed interesting comparisons. High-density metal halide solutions were compared with lead glass and with rare earth glass for use as shielding windows. Laminated shields of lead-paraffin and uranium-paraffin were compared with water and with paraffin for shielding walls. Measurement of samples of the mixed shielding materials compared reasonably with published data, where available. On the basis of the figures obtained dose-attenuation factors were computed for various thicknesses of the materials tested. (auth)

16320 USNRDL-TR-318
Naval Radiological Defense Lab., San Francisco.
ENERGY SPECTRUM OF GAMMA RADIATION FROM FALLOUT. C. S. Cook. Apr. 24, 1959. 26p.

The results of fall-out sample gamma-ray spectral measurements using NaI(Tl) crystal scintillation spectrometers are analyzed. The summary of the information indicates that, for those detonations at which gamma-ray spectral characteristics of deposited fallout have been measured, there appears to be no positive correlation between spectral characteristics and weapon yield, weapon type, or conditions of detonation. Comparisons have been made between the experimental results and the calculational predictions of Nelms and Cooper for the gamma radiation from the products of slow neutron fission of U^{235}. Although the agreement is good in some energy intervals, there are rather large discrepancies in other energy intervals. The mean energy per photon in the time interval between 10 and 3000 hours after detonation appears to be not too different from 0.7 Mev/photon if some shielding is provided to screen out low-energy photon radiations. (auth)

16321 WAPD-BT-13
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. May 1959. 111p. Contract AT-11-1-GEN-14. $2.50(OTS).

Seventeen papers are presented on reactor physics and mathematics. Separate abstracts have been prepared for each paper. (W.L.H.)

16322 WAPD-BT-13(p.1-7)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
DELAYED NEUTRONS IN REACTOR KINETICS CALCULATIONS. R. L. Ewen and R. S. Wick. p.1-7 of BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 7p.

The effect of recent changes in basic delayed neutron data on the reactivity inferred from period measurements is considered. The measured delayed neutron yields and precursor half lives reported for U^{235} by Hughes (1948), Keepin (1955), and Keepin (1957) result in different core reactivity evaluations. Also investigated is the effect on the effective delayed neutron fraction if all delayed neutrons are assumed born into one of 54 energy groups; this simplification is found to be consistent with the accuracy of the basic delayed neutron data. (auth)

16323 WAPD-BT-13(p.8-12)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh. ANALYSIS OF FLUX SHAPES IN CRITICAL ASSEMBLIES. R. L. Ewen and I. Itkin. p.8-12 of BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 5p.

Experimentally determined flux shapes and relative magnitude of flux obtained in a light-water reflected, Zircaloy—uranium metal, light-water-moderated reactor are compared to those obtained by several theoretical techniques. These techniques consist of "synthesizing" three-dimensional flux shapes from the results of one- and two-dimensional diffusion theory calculations. The best agreement between theoretical calculations and experimental results were obtained with schemes involving either flux weighting over the entire cross section of a core, or the use of flux-weighted equivalent homogeneous constants and a cell correction factor. (auth)

16324 WAPD-BT-13(p.13-25)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh. PARTIAL WATER-HEIGHT EXPERIMENTS WITH A WATER-MODERATED, HIGHLY ENRICHED, HETEROGENEOUS CRITICAL ASSEMBLY. S. H. Levine. p.13-25 of BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 13p.

Presented at the June 1957 ANS meeting, Pittsburgh.

A series of experiments was performed with highly enriched light-water-moderated cores, all of which were 6 in. wide, but of different lengths. Two methods, one kinetic and the other static, were used to infer the excess reactivity of these cores, with excess reactivity ranging from 1.2 to 3.6% $\delta k/k$. From these data, the age of the assembly was inferred on the basis of the two-group model. (auth)

16325 WAPD-BT-13(p.26-37)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh. FLOW DISTRIBUTION IN A PARALLEL CHANNEL PRESSURIZED WATER REACTOR. A. S. Rathbun. p.26-37 of BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 12p.

The important problem of flow distribution in a parallel channel pressurized water reactor is considered. The variations of flow caused by changes in nuclear core length, flow area per unit heat transfer area per unit length, inlet subcooling, and pressure in the high flow region, crossover region, and low flow region are examined. The development of the mathematical model for the solution of the flow distribution is presented, showing the selection of pressure drop equations and the combination of these equations into suitable code form. (auth)

16326 WAPD-BT-13(p.38-47)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh. DIGITAL SOLUTION OF REACTOR THERMAL TRANSIENTS. J. M. Weaver. p.38-47 of BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 10p.

The ability to predict realistically the nuclear processes going on within reactors has been revolutionized by the application of high speed digital computers. This article describes an approach which has been used to predict the transient thermal response of a plate-type pressurized water reactor in forced convection and nucleate boiling heat transfer regions. Examples are presented to demonstrate the types of problems which have been solved and the information gained from the solutions. (auth)

16327 WAPD-BT-13(p.48-52)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh. PORTABLE XENON SIMULATOR. T. E. Fairey and S. O. Johnson. p.48-52 of BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 5p.

Reactor operators are constantly confronted with the problem of predicting reactivity changes inherent in the reactor. Of such reactivity changes, the reactivity of Xe-135 poison is probably the most difficult to predict because it not only changes with time, but depends in a complicated fashion upon the existing power level and upon the reactor operating power history for the previous 50 hours. The small portable simulator described in this article computes, on an accelerated time basis, xenon reactivity information for the particular power history encountered by a reactor. (auth)

16328 WAPD-BT-13(p.53-64)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh. ORDERINGS OF THE SUCCESSIVE OVERRELAXATION SCHEME. R. S. Varga. p.53-64 of BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 12p.

In solving difference equations arising from numerical approximations to elliptic partial differential equations in two and higher dimensions by certain iterative techniques, there arises the question of characterizing the particular form of mesh sweep which optimizes the convergence rates of the iterative techniques. This question is specifically answered for a large class of difference equations having application to the numerical solution of reactor problems. In addition, a well-known result of Stein and Rosenberg on matrices is improved upon. (auth)

16329 WAPD-BT-13(p.65-8)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh. THE USE OF EXTRAPOLATION TO INCREASE THE RATE OF CONVERGENCE IN EIGENVALUE PROBLEMS. G. G. Bilodesu. p.65-8 of BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 4p.

One of the most popular methods for determining the largest eigenvalue (in absolute value) of a matrix is the method which makes use of the powers of the matrix. Because the convergence of this scheme can be quite slow, a method is studied here which contains the power method as a special case and which, in general, defines an "extrapolation" of the power method. Rates of convergence are compared and results are obtained relating this newer scheme to methods discussed in the literature. (auth)

16330 WAPD-BT-13(p.69-79)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh. CLEBSCH GORDAN COEFFICIENTS, $C_{j_1 j_2}$ (jm; $m_1 m_2$), FOR $j_2 = 4$. P. A. Ombrellaro. p.69-79 of BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 11p.

Algebraic tables of transformation amplitudes for the vector addition of angular momenta $\bar{j}_1 + \bar{j}_2 = \bar{j}$ are extended in the literature by the addition of coefficients resulting when $\bar{j}_2 = 4$. The new coefficients are calculated from formulas derived by Racah and Wigner and a recursion formula given by Condon and Shortley. These coefficients can be used in nuclear reaction differential cross-section calculations. (auth)

16331 WAPD-BT-13(p.80-4)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE ART PROGRAM FOR THE DIGITAL SOLUTION OF REACTOR THERMAL TRANSIENTS. J. E. Meyer and R. B. Smith. p.80-4 of BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 5p.

An important area of concern in reactor safety calculations is that of transient performance. The ART program for the IBM-704 has been developed to aid in assessing reactor behavior during loss of flow, rod withdrawal, and cold water accidents. The program is described briefly in this article and more completely in a referenced report. (auth)

16332 WAPD-BT-13(p.85-6)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE FLIP CODE-SOLUTION OF P_L AND DOUBLE-P_L EQUATIONS. B. Anderson, J. Davis, E. Gelbard, and P. Jarvis. p.85-6 of BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 2p.

The IBM-704 FLIP code solves the one-velocity P_L and double-P_L equations in slab geometry. The basic equations and method of solution are described. Some advantages of the FLIP method over more conventional techniques are briefly noted, and the document giving a complete description of the code is referenced. (auth)

16333 WAPD-BT-13(p.87-8)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
P1MG—A ONE-DIMENSIONAL MULTIGROUP P_1 CODE. E. M. Gelbard and H. Bohl. p.87-8 of BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 2p.

P1MG, a one-dimensional, multigroup P_1 code programmed for the IBM-704, is described briefly. It was designed to assess the accuracy of the few-group diffusion scheme and to provide an alternate computational device when this scheme fails. The document giving a complete description of the code is referenced. (auth)

16334 WAPD-BT-13(p.89-92)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
TURBO—A PROGRAM FOR TWO-DIMENSIONAL DEPLETION CALCULATIONS. O. J. Marlowe and J. E. Meyer. p.89-92 of BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 4p.

A nuclear designer must supply information on critical control rod positions and three-dimensional power shapes for various reactor core depletions and xenon conditions. The TURBO program on the IBM-704 computer which may be used for this purpose is discussed. The method for solving two-dimensional few neutron group diffusion problems at various stages of depletion for flux and power shapes is presented. (auth)

16335 WAPD-BT-13(p.93-6)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PDQ-2—A TWO-DIMENSIONAL FEW-GROUP DIFFUSION CODE. W. R. Cadwell. p.93-6 of BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 4p.

Available codes for solving few-group, time-independent, neutron-diffusion problems in two dimensions were not considered fast enough or simple enough to handle the volume of such problems required for nuclear reactor design. Therefore, the PDQ-2 code, which solves a typical problem in one hour, was developed for the IBM-704. The code is described and the background documents are referenced. (auth)

16336 WAPD-BT-13(p.97-8)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
DRACO—A THREE-DIMENSIONAL FEW-GROUP DEPLETION CODE. D. S. McCarty. p.97-8 of BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 2p.

DRACO is a three-dimensional, few-group depletion code programmed for the IBM-704. It is used to eliminate the reactivity, the neutron flux distribution, and the related buildup and depletion of material at different stages in the lifetime of a reactor. The code is briefly described, and the background documents are referenced. (auth)

16337 WAPD-BT-13(p.99-101)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PROP AND JET—A PROGRAM FOR THE SYNTHESIS AND SURVEY OF THREE-DIMENSIONAL POWER SHAPES. J. E. Meyer and J. B. Callaghan. p.99-101 of BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 3p.

The use of a two-dimensional depletion code for synthesis of three-dimensional power shapes in a reactor has presented the thermal analyst with an enormous data problem. For this reason, the PROP and JET program has been developed to form a power shape at each time in core life by combining two-dimensional and one-dimensional results and to select those regions of the core, which are most limiting thermally, for more detailed analysis. The program is described briefly in this article and more completely in a referenced report. (auth)

16338 WAPD-BT-13(p.102-3)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
TKO-1—A THREE-DIMENSIONAL FEW-GROUP DIFFUSION CODE. W. R. Cadwell. P.102-3 of BETTIS TECHNICAL REVIEW. REACTOR PHYSICS AND MATHEMATICS. 2p.

TKO-1, developed for the IBM-704, is the first three-dimensional, few-group, neutron-diffusion code written at Bettis Plant. It has proved valuable for reactor design calculations, and has provided considerable insight to difficulties encountered in three-dimensional calculations. The code is briefly described, and the document giving a complete description of the code is referenced. (auth)

16339 Y-1250
Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.
IN VIVO GAMMA COUNTING METHOD OF DETERMINING URANIUM LUNG BURDEN IN HUMANS. R. E. Cofield. May 22, 1959. 33p. Contract W-7405-eng-26. $1.00(OTS).

An in vivo method for determining the lung burden of uranium in the human body is reported. Scintillation spectrometry is used to measure the gamma activity from the uranium. The in vivo gamma counting facility includes a low background counting chamber, a large thallium-activated sodium iodide scintillation crystal, and a 256-channel pulse height analyzer. Two techniques are described for determining the normal in vivo activity in the uranium spectral area. Calibrations have been derived from measurements of phantoms simulating the human chest. The limit of detection is about 130 μg U^{235} in the chest. Employing a 30-minute counting interval, analyses within fifty percent of the maximum permissible body burden of insoluble uranium are possible if the isotopic concentration of the element is known. (auth)

16340 AEC-tr-3723
SKIN EFFECT IN SOLID CONDUCTORS EMBEDDED IN CIRCULAR SLOTS. R. Tuschak. Translated for Atomics International from Periodica Polytech. (Elec. Eng.) 1, 27-51(1957). 26p. $4.80(ph), $2.70(mf) JCL.

Equations are presented for determining the resistance and the slot leakage resistance of the solid conductors embedded in circular slots, taking into account the skin effect. The rotor impedance of synchronous motors with double cage rotors are determined. (W.L.H.)

16341 AEC-tr-3725
THEORY OF SPACE CHARGE PHENOMENA. (Zur Theorie der Raumladungerscheinungen.) Paul Epstein. Translated for Los Alamos Scientific Lab. from Ber. deut. physik. Ges. 21, 85-99(1919). 12p. $3.30(ph), $2.40(mf) JCL.

A need was found for a space charge theory based on kinetic foundations and rigorously considering all boundary conditions. Equations were developed for the simplest case, one-dimensional, assuming the Child-Langmuir equation as a first approximation. Results obtained through the equations are compared with experimental measurements. (D.E.B.)

16342 AERE-Trans-818
INDUCTION MACHINES WITH OPEN MAGNETIC CIRCUITS. G. I. Shturman. Translated by P. Collins (U.K.A.E.A. Atomic Energy Research Establishment) from Elektrichestvo, No. 10, 43-50(1946). 20p.

Basic propositions on the theory of induction machines with open magnetic circuits are formulated, which give quantitative evaluation of the electromechanical properties and technical and economic criteria of asynchronous motors with arc and plane stators. The problem of the excitation conditions of the fields when the magnetic circuit is "opened up" is examined. The results of experiments confirming the laws discovered are given. (auth)

16343 AERE-Trans-819
"EDGE EFFECT" IN INDUCTION MACHINES WITH OPEN MAGNETIC CIRCUITS. G. I. Shturman and R. L. Aronov. Translated by P. Collins (U.K.A.E.A. Atomic Energy Research Establishment) from Elektrichestvo, No. 2, 54-9(1947). 12p.

A general discussion is given of the electromechanical processes involved in the working of asynchronous motors having arc and plane stators. Quantitative laws are established which determine the currents in the secondary circuit of the machine. From the results of the analysis of the mechanical forces developed, the time-pulsating forces of the mutual action between the fields in the gap and the primary and secondary currents are ascertained. The changes in the electromechanical properties of asynchronous motors, resulting from the opening-up of the magnetic circuit, are illustrated by data from a calculated example. (auth)

16344 CEA-tr-R-632
TEMPÉRATURE DES ÉLECTRONS DANS UN PLASMA DANS UN CHAMP ÉLECTRIQUE VARIABLE. (Electron Temperature in a Plasma in a Variable Electric Field.) A. V. Gurevich (Gourevitch). Translated into French from Zhur. Eksptl'. i Teoret. Fiz. 35, 392-400(1958). 22p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 3181.

16345 IGR-T/R-61
PHYSICAL PRINCIPLES OF THE TRENNDUSE METHOD. [PART I]. G. Nardelli and A. Repanai. Translated by B. Rigby (U.K.A.E.A., Risley) from Energia nucleare (Milan) 4, 293-300(1957). 12p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 390.

16346 IGRL-T/R-72
THE UTILIZATION OF TIDAL ENERGY. M. Vantroys. Translated by E. G. Peters (U.K.A.E.A., Atomic Risley) from Ann. inst. tech. bâtiment et trav. publ., Suppl., 320-36(1955). 24p.

The EDF (Electricité de France) proposes that the plans for utilizing tides be advanced from small-scale tidal mills to the stage of power stations of average power and that the design of stations of even greater power be continued. The cause of the tides and their variation with the relative positions of the earth, moon, sun, and the contour of the shoreline are discussed. Mean heights of spring tides at the equinoxes at various parts of the world are shown. Points of highest tides are indicated. The EDF is studying a project on the estuary of the Rance which, it is hoped, will eventually produce about 500 million kwh/yr at an installed power of about 200,000 kw. (A.C.)

16347 JPRS-1128-N
APPLICATION OF RADIOISOTOPES IN USSR INDUSTRY. Translation of Abstracts of data published in the Russian-language publication: "A Method for the Absolute Measurement of the Activity of Beta-Radiation Sources by Means of End-Window Counters," by I. B. Keirim-Marcus and M. A. L'vova. 15p. $1.00(OTS).

Absolute methods of measuring beta radiation with end window counters are discussed. General information on counting techniques is reviewed and problems of self-absorption and self-scattering of beta radiation are discussed. (C.H.)

16348 JPRS-TR-L-578-N
A CHARGING GADGET FOR POCKET DOSIMETERS. Ye. V. Utekhin. Translated from Med. Radiol. 3, No. 3, 68-9(1958). 3p. $0.50(OTS).

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 14134. (C.H.)

16349
THE COSMIC DISPERSION OF ELEMENTS. II. THEIR GENESIS. C. G. Bedreag. Acad. rep. populare, Romîne, Baza cercetări ştiinţ. Timişoara, Studii cercetări ştiinţe chim. 5, 23-30(1958). (In Rumanian)

It is shown that the cosmic abundance of elements decreases rapidly from the first light elements toward the heavy elements. The abundance of elements with even Z is higher than that of elements with odd Z. The cosmic abundance has a periodicity with respect to the atomic numbers Z, with Z = 12, 12, 14, 12, 12, 14, 12. The spectral distribution of elements in nebulae and in the spectral categories O, B, A, F, G, K, M, N, and R is given. The genesis or cosmic synthesis of elements is discussed. (tr-auth)

16350
EMISSION SPECTRUM OF COPPER-ACTIVATED ZINC SULFIDE IN THE PARTIAL THERMAL EXTINCTION REGION. Hughes Payen de la Garanderie and Daniel

Curie. Compt. rend. 248, 3151-3(1959) June 1. (In French)

The emission spectrum of irradiated ZnS ($7 \times 10^{-5}\%$ Cu, 3% NaCl) was examined. The width observed is attributed to a color center-lattice interaction. (T.R.H.)

16351

MAGNETIC SUSCEPTIBILITY OF GRAPHITE AND GRAPHITIZED CARBONS. EFFECTS OF MAGNETIC FIELD. Nicole Lumbroso-Bader and André Marchand. Compt. rend. 248, 3433-5(1959) June 15. (In French)

The Faraday method was used to study the magnetic susceptibility of P-33 carbon black, a Texas Lockport coke, and graphite. Measurements were made at 7,000 and 12,500 gauss. It was found that the susceptibility of the graphitized materials did not vary more than 0.5% for doubling the field strength indicating that for a model where $E = \pm A|P|^n$, n does not vary from 1 by more than 0.01. For graphite the susceptibility varied no more than 0.3% for a field varying in the ratio 1 to 4; n would not differ from 1 by more than 0.002 for this model. (T.R.H.)

16352

ON ONE METHOD OF PROGRAMMING. V. S. Korolyuk (Inst. of Mathematics, Academy of Sciences, Ukrainian S.S.R.). Dopovidi Akad. Nauk Ukr. R.S.R. No. 12, 1292-5(1958). (In Ukrainian)

A method of programming, not connected with the technical peculiarities of concrete digital automatic machines, is outlined, which contains the basic logical principles of programming—addressibility and cyclicity. Application of this method makes it possible to introduce formal conversions of the programs, permits automatic translation into programs for concrete machines, and enables the formulation of recommendations for the technical improvement of machines. (auth)

16353

ON THE NATURE OF SUPERNOVA OUTBURSTS. I. M. Gordon and V. N. Lebedinets (Skovorod Khar'kov State Pedagogical Inst.). Dopovidi Akad. Nauk Ukr. R.S.R. No. 12, 1320-3(1958). (In Ukrainian)

A precise calculation is made of the mass of a supernova shell, taking into consideration the change in density. It is shown, that taking into consideration the change in density does not affect the order of the shell mass. Considering the scattering of light on free electrons, the mass of the isothermal envelope exceeds 10 $m_\odot$ at $T = 10^{4°}$ and $M = -19^m$, which demands a more average value for the temperature. At a temperature $T = 10^{6°}$ the required mass, on taking into consideration the scattering of light on free electrons, is 8 $m_\odot$, which considerably exceeds the mass of the Crab nebula. The bolometric luminosity with standard chemical composition gives -29^m, which leads to insurmountable difficulties for the thermal mechanism of accretion of briliancy. A change in the temperature and chemical composition cannot lead to a substantial decrease in the bolometric luminosity and the shell mass. Thus, the inference as to the nonthermal nature of supernova radiation, drawn earlier by one of the authors, receives further confirmation. (auth)

16354

DESCRIPTION OF AN APPARATUS FOR THE PRODUCTION OF AN ARGON PLASMA BEAM WITH STABLE ELECTRODES AND MEASUREMENT OF THE TEMPERATURE DISTRIBUTION IN THE PLASMA BEAM. Werner Neumann, Arnold Peters, Karl Rademacher, and Robert Rompe (Deutsche Akademie der Wissenschaften, Berlin). Exptl. Tech. Physik 7, 77-84(1959). (In German)

An apparatus for the production of an argon plasma beam is described. The plasma is produced in a high-current arc between a cylindrical tungsten cathode and a water-cooled ring anode of copper. The plasma is emitted in a gas current from the ignition chamber through the ring cathode. The hotter part of the plasma with T = 9000°K is obtained at a current strength of 500 amp and a gas throughput of 500 l/hr along a length of 15 mm. The maximum temperature is approximately 15,000°K. The temperature distribution of the plasma beam is determined through monochromatography at a wave length of 5560 A with a consideration of the electron-ion collision continuum. A fusion investigation with tungsten was carried out. (tr-auth)

16355

A STUDY OF THE TRAPPING CENTRES OF X-RAY IRRADIATED CRYSTALS OF QUARTZ WITH Na IMPURITY IONS. Ye. N. Batrak. Kristallografiya 3, No. 1, 104-6(1958).

The thermal characteristics of the trapping centers in x-irradiated quartz crystals were investigated. A natural quartz crystal with two reproducible maxima on the thermal luminescence curve and a quartz with sodium-ion impurities with one maxima were used for the study. The samples were irradiated, and the thermal luminescence curves were obtained. The data gave a thermal ionization energy $E_T = 1.27$ ev and a probability of isoenergetic transition p_0 of the order of 3×10^8 sec^{-1}. These values were obtained for a clouded quartz containing sodium ions. It was found that a crystal subjected to multiple radiations gives stronger luminescence. (J.S.R.)

16356

THE RADIOGRAPHY OF GRAPHITE. (INTERNATIONAL COOPERATION GIVES LEAD TO POWELL DUFFRYN). Nuclear Power 4, No. 37, 114-15(1959) May.

A complete x-ray installation for the radiographic inspection of graphite is described. The design enables 100% radiography to be carried out at the end of the production line following physical and dimensional inspection. (A.C.)

16357

THERMIONIC CONVERTERS. Karl G. Hernqvist (RCA, Princeton, N. J.). Nucleonics 17, No. 7, 49-53 (1959) July.

Thermionic converters and recent experiments at Los Alamos are described. It is difficult for thermoelectric converters to reach thermal efficiencies of 10%, however, thermionic converters are expected to reach efficiencies of 25 to 30% in the near future. High efficiencies require a heat source that can operate at temperatures around 2000°F. Thermionic converter performance is tabulated. (A.C.)

16358

SURVEY OF GAMMA FACILITIES IN U. S. AND CANADA—AN UPDATING. Nucleonics 17, No. 7, 88(1959) July.

Nucleonics recently made a survey of industrial gamma facilities in the U. S. and Canada. A tabulation of gamma facility characteristics brought up to date by a recent questionnaire is given. (A.C.)

16359

WATER-COOLED X-RAY TARGET PRODUCES UP TO 10^8 r/hr. Charles D. Wagner and V. A. Campanile

(Shell Development Co., Emeryville, Calif.). Nucleonics 17, No. 7, 99(1959) July.

A gold x-ray target is described which is capable of absorbing the entire 3,000 watt electron beam from a Van de Graaff accelerator. A radiation of 10^8 r/hr was obtained in a volume of 1 cm^3 close to the face of the target. This is believed to be the highest neutron-free dose rate ever achieved. (A.C.)

16360

MULTIPLE PHOTON PRODUCTION IN COMPTON SCATTERING AND BREMSSTRAHLUNG. R. C. Majumdar, V. S. Mathur, and J. Dhar (Univ. of Dehli). Nuovo cimento (10) 12, 97-105(1959) Apr. 16.

The multiple photon production in Compton scattering at high energies is investigated from the Feynman-Dyson formalism of quantum electrodynamics. It is observed that the multiple Compton scattering cross-section is largest when the photons emitted are all soft except one and differs from the single Compton scattering by a multiplicative factor, which increases with increasing energy of the incident photon. The multiple cross-section for bremsstrahlung at high energies is then obtained by the Williams-Weizsäcker method. The emission of about four hard photons within an extremely narrow cone is shown to be a plausible estimate. (auth)

16361

LANGEVIN EQUATION AND THE ac CONDUCTIVITY OF NON-MAXWELLIAN PLASMAS. P. Molmud (Space Technology Labs., Inc., Los Angeles). Phys. Rev. 114, 29-32(1959) Apr. 1.

The use of the Langevin equation $\{dv/dt + gv = (q/m)[E_0 e^{i\omega t} + (v/c) \times H]\}$ to describe the electrical conductivity of a non-Maxwellian plasma (a weakly ionized gas in which the average electron collision frequency is temperature dependent) may be in error unless it is understood that the dissipative term, g, is complex. In the limiting cases of either high or low pressures the imaginary part of g is negligible. The real and imaginary parts of g are evaluated for these limiting cases, for four different gases; air, helium, Maxwellian gas, and water. The real part of g is shown to be the average collision frequency multiplied by a numerical factor, the size of which depends on the nature of the gas and the pressure limit. (auth)

16362

EXCITATION FUNCTIONS OF BISMUTH AND LEAD. W. J. Ramler, J. Wing, D. J. Henderson, and J. R. Huizenga (Argonne National Lab., Lemont, Ill.). Phys. Rev. 114, 154-62(1959) Apr. 1.

Cross sections for the reactions $Bi^{209}(He^4,2n)At^{211}$, $Bi^{209}(He^4,3n)At^{210}$, and $Bi^{209}(He^4,4n)At^{209}$ were measured with helium ions of energies from 20.6 to 43.3 Mev. Cross sections for the reactions $Bi^{209}(d,p)RaE$, $Bi^{209}(d,n)Po^{210}$, $Bi^{209}(d,2n)Po^{209}$, $Bi^{209}(d,3n)Po^{208}$, and $Pb^{208}(d,p)Pb^{209}$ were measured with deuterons of energies from 6.3 to 21.5 Mev. Some information is presented on the $Bi^{209}(He^4,t)Po^{210}$ reaction. A half life of 7.23 ± 0.04 hr was measured for At^{211}. The $Bi^{209}(d,3n)Po^{208}$ threshold energy is 12.0 ± 0.3 Mev (center-of-mass system). The compound nucleus reaction cross sections are compared with the predictions of the Jackson model, and good agreement is obtained. The (d,n) and (d,p) stripping cross sections are discussed briefly. (auth)

16363

HYDROMAGNETIC EQUILIBRIUM. II. STABILITY IN THE VARIATIONAL FORMULATION. L. Woltjer. Proc. Natl. Acad. Sci. U. S. 45, 769-71(1959) June.

Two points in an earlier paper are clarified: the set of integrals offered previously was not complete; and an incorrect statement concerning the stability of equilibria was made. (T.R.H.)

16364

ON A SYMMETRY IN WEAK INTERACTIONS. A. Gamba, R. E. Marshak, and S. Okubo (Univ. of Rochester, N. Y.). Proc. Natl. Acad. Sci. U. S. 45, 881-5(1959) June.

A symmetry principle is postulated and investigated. All weak interactions are invariant under the following simultaneous transformation: $\Lambda \rightleftarrows \mu$, $n \rightleftarrows e$, $p \rightleftarrows \nu$. It is found that this transformation does not contradict any of the known facts and leads to predictions which can be tested. (T.R.H.)

16365

DISPERSION RELATIONS AND VERTEX PROPERTIES IN PERTURBATION THEORY. K. Symanzik (Max-Planck-Institut für Physik, Göttingen, Ger.). Progr. Theoret. Phys. (Kyoto) 20, 690-702(1958) Nov.

Dispersion relations for nucleon-nucleon scattering with momentum transfer $2|\Delta| < \mu$, for meson-nucleon scattering, and related properties of the meson-nucleon vertex, are shown to hold in every order perturbation theory. This is done by extending a method used by Nambu to discuss the perturbation-theoretical parametric representations of Green's functions. In effect arbitrarily complicated Feynman diagrams are reduced to a few simple types. (auth)

16366

EQUILIBRIUM PROPERTIES OF CLASSICAL ELECTRON GAS IN UNIFORM POSITIVE ION DISTRIBUTION. Yoshi H. Ichikawa (Tohoku Univ., Sendai, Japan). Progr. Theoret. Phys. (Kyoto) 20, 715-27 (1958) Nov.

Thermal equilibrium properties of a classical electron gas are investigated by taking into account the plasma oscillation mode. The free energy is calculated in terms of collective coördinate representation. It is shown explicitly that the Debye-Hückel limiting term of the free energy is due to short range correlation part of the Coulomb interaction, and that the long range correlation effect increases the free energy by 22% of the Debye-Hückel term. (auth)

16367

NOTES ON THE MAGNETIC MIRROR EFFECT. Masatomo Sato (Nihon Univ., Tokyo). Progr. Theoret. Phys. (Kyoto) 20, 737-42(1958) Nov.

An elementary theory is presented to estimate the rate of charged particle loss from the ends of a magnetic mirror device. (auth)

16368

A GENERAL THEORY OF MAGNETIC DOUBLE RESONANCE. Kazuhisa Tomita (Univ. of Kyoto). Progr. Theoret. Phys. (Kyoto) 20, 743-73(1958) Nov.

A general theory is presented for describing a system which consists of two interacting different species of spin, one of them being saturated by a strong resonant radiation field and the other being detected by a weak resonant radiation field. Two rather different extreme cases are classified according to the relative magnitude of the static strength of the mutual interaction σ_0 and the characteristic frequency of fluctuation ϕ_0 of the relevant environment. A) When the fluctuation of the environment dominates ($\phi_0 \gg \sigma_0$), then the situation which may be called a generalized "Overhauser effect" is indicated, i.e., the process of saturation works as an energy pumping. Without the effect of the continuous saturation the simultaneous equation reduces to a generalized Solomon equation originally proposed for describing the coupled free induction of two kinds of nuclear spin system. B) If, on the other hand, the static strength of the mutual interaction dominates over the fluctuation ($\sigma_0 \gg \phi_0$), then there results a phenomenon called "Saturational narrowing," i.e., the process of saturation works as a local field modulation. This latter case is illustrated by an application to the double resonance experiment on thallous fluoride crystal. (auth)

16369
GROUND STATE ENERGY OF BOSE PARTICLE SYSTEM. Ryuzo Abe (Tokyo Inst. of Tech.). Progr. Theoret. Phys. (Kyoto) 20, 785-97(1958) Dec.

The ground state energy of the Bose particle system at low densities is investigated by using a method based on summing the terms of conventional perturbation series, giving rise to the lowest order with respect to density. The summation is shown to be greatly simplified if the scattering matrix is introduced, and a simple example is demonstrated for the repulsive square well potential by calculating a few terms of the series, first directly and secondly with the aid of scattering matrix. The final result is shown to be valid both for weak and strong interactions and the calculation is carried out analytically for some types of potential function. The connection of the method with the pseudopotential method and with the Brueckner theory is investigated, and some problems associated with the attractive interactions are discussed. (auth)

16370
INFLUENCE OF THE EXCHANGE AND CORRELATION ON THE ELECTRON-PHONON INTERACTION IN METALS. Tomiyuki Toya (Hokkaido Univ., Sapporo). Progr. Theoret. Phys. (Kyoto) 20, 971-2 (1958) Dec.

Bearden and Pines investigated the role of electron-electron interactions in metals by extending the Bohm-Pines collective description method. It was concluded that exchange and correlation effects on the dispersion relation $\omega(q)$ and on the effective matrix element $V_p(q)$ for electron-phonon interaction is negligible for the small wave number vector q of a phonon. Further investigation leads to the conclusion that $\omega(q)$ and $V_p(q)$ must include the exchange and correlation terms even for small q. (A.C.)

16371
A NOTE ON THE ELASTIC SCATTERING OF HIGH ENERGY DEUTERONS BY COMPLEX NUCLEI. Yoshihiko Nishida and Hiromi Tanaka (Saga Univ., Japan). Progr. Theoret. Phys. (Kyoto) 20, 976-9 (1958) Dec.

Results obtained by applying the A-S theory to elastic scattering of 156-Mev deuterons by carbon are reported. The effect of simultaneous scattering is shown and compared with results previously reported by Stapp. (A.C.)

16372
ON THE REPRESENTATIONS OF FIELD QUANTITIES. II. Hitoshi Wakita (Hiroshima Univ.). Progr. Theoret. Phys. (Kyoto) 21, 299-314(1959) Feb.

A study was made to determine whether the framework of a Hilbert space is compatible with the quantum theory of fields. An inquiry is made as to the characteristic features of field theory and how these features can be described in this framework. For this purpose the character of additive field theories, which are used in place of field operators, and the relation between a system extending over the whole space and one restricted within a finite volume are examined. After these considerations the conclusion was made that there is sufficient reason to treat the quantum theory of fields within the framework of a Hilbert space. (A.C.)

16373
NEUTRINO AND GRAVITY. Satio Hayakawa (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 21, 324-6(1959) Feb.

Since the neutrino is completely polarized along its travelling direction, a β decay results in the loss of angular momentum from the universe. As a result of its recoil, the universe begins to rotate, thus violating the mirror symmetry of space. Although the average rotational motion vanishes due to random β decays, the mean square angular velocity remains finite. This causes the centrifugal acceleration which, according to the equivalence principle, should be equated to the gravitational acceleration due to the loss of neutrino energy. This could take a part in the origin of gravity; the value of the gravitation constant calculated by the above idea is not unreasonable. (auth)

16374
GAUGE INVARIANCE AND THE MEISSNER EFFECT. Nobuyuki Fukuda and Yasushi Wada (Tokyo Univ. of Education) and Shuichi Otake (Tokyo Science Coll.). Progr. Theoret. Phys. (Kyoto) 21, 343-53(1959) Feb.

A gauge invariant theory of a many electron system in an external magnetic field, interacting through arbitrary velocity dependent two-body forces, is presented. The energy spectrum for a "free" electron is also assumed to be arbitrary to take into account the self-energy due to its interaction with the phonon field. If the two-body forces are neglected, it is shown that no Meissner effect is obtained so long as the energy spectrum is continuous together with its first order derivative. Bardeen's energy gap model is reconsidered from this standpoint and is shown to be drastically changed. (auth)

16375
ON THE GAUGE-INVARIANT MEISSNER EFFECT. Sadao Nakajima (Nagoya Univ., Japan). Progr. Theoret. Phys. (Kyoto) 21, 357-8(1959) Feb.

Bardeen suggested that it is essential that plasma excitation be considered in order to obtain the gauge-invariant Meissner effect. Blatt and Matsubara recently showed that the gauge-invariant Meissner effect results even in Fröhlich's Hamiltonian if longitudinal collective excitation is included. Bardeen's original suggestion seems to be confirmed, and it appears that the non-gauge-invariant term in BCS theory introduces a minor error in the normal part of the diamagnetic current. (A.C.)

16376
A NOTE ON THE ERGODIC THEOREM FOR QUANTIZED SYSTEMS. Chang Tsung-sui. Wu Li Hsüeh Pao 14, 400-4(1958) Sept. (In Chinese)

In a paper by Klein, it is pointed out that for the quantum mechanical ergodic theorem (time average = average over states) to be valid, all integrals of motion R must satisfy the condition $\Sigma_{\rho''}(\alpha'\rho''|R|\beta'\rho'') = \text{const}\ \delta_{\alpha'\beta'}$, where α', β', γ', $\cdots$refer to the assembly under question and α'', β'', $\cdots$, ρ'', $\cdots$refer to the surrounding with which the assembly is in equilibrium. In this short note, it is pointed out that the argument of Klein is doubtful at one point and a slightly different approach is given. In this approach, it is shown that (1) is actually sufficient, but only after introducing an additional assumption that the different states of the surroundings have equal probabilities, and that in general, a stronger condition such as $(\alpha'\rho''|R|\beta'\theta'') = \text{const}\ \delta_{\alpha'\beta'}\delta_{\rho''\theta''}$ is needed. Cases with integrals of motion are also considered. First an isolated system is considered, with the wave function $<\alpha_1\alpha_2|>$, where α_1 represents a set of commuting integrals of motion and α_2 a set of observables not containing integrals of motion and introduce the assumption that for any integral of motion R, the matrix $<\alpha_1'\alpha_2'|R|\alpha_1''\alpha_2''>$ representing it is of the form $\phi(\alpha_1',\alpha_1'')\delta\alpha_2'\alpha_2''$. Under such conditions, it is proved that if the initial state of the system is an eigenstate of α_1 corresponding to the eigenvalue α_{10}, then the average of an observable F over time is given by $\Sigma_{\alpha_2}<\alpha_{10}\alpha_2|F|\alpha_{10}\alpha_2>/\Sigma_{\alpha_2}<\alpha_{10}\alpha_2|1|\alpha_{10}\alpha_2>$, a result which is clearly to be expected. Extension to systems interacting with external surroundings is easily made. (auth)

16377

OPTICAL ABSORPTION OF CdS SINGLE CRYSTALS AT THE FUNDAMENTAL LATTICE ABSORPTION EDGE. K. W. Böer and H. Gutjahr (Humboldt-Universität, Berlin and Physikalisch-Technischen Instituts der DAW, Berlin). Z. Physik 155, 328-31(1959). (In German)

It is shown that for CdS optical absorption at the edge of the fundamental lattice absorption is determined by indirect band—band transitions with participation of phonons. At room temperature both absorption branches are evident, not only for absorption but also for emission of a phonon. The characteristic phonon energy is yielded. (tr-auth)

16378

THE PERIOD OF THE 1.416-Mev LEVEL OF RADIUM C'. M. Tutter (Max-Planck-Institut für Kernphysik, Heidelberg, Ger.). Z. Physik 155, 368-79(1959). (In German)

The average half life of the 1.416-Mev level of RaC' was found to be (2.3 ± 1.9) $\times 10^{-10}$ sec by the delayed coincidence method. (tr-auth)

16379

SMALL SUN FLARE EFFECTS AND THE ENERGY SPECTRUM OF THE PRIMARY COSMIC RAY VARIATIONS. E. V. Kolomeets (Kazach State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1351-3(1959) May. (In Russian)

The relation between the intensity of cosmic-ray neutrons and chromospheric flares on the sun was studied on the basis of the data obtained from four stations located at various latitudes. By the epoch superposition method a small flare effect was found to occur at each of the above mentioned stations. With the aid of coupling constants the energy spectrum of particles of the supplementary beam was determined. (auth)

16380

EFFECT OF PRESSURE AND TEMPERATURE ON THE RAMAN SPECTRUM OF NITROGEN. G. V. Mikhailov (Lebedev Inst. of Physics, Academy of Sciences, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1368-73(1959) May. (In Russian)

The rotational structure of the Q branch in the vibrational band of the Raman spectrum of nitrogen is studied. Impact broadening of the vibrational and rotational spectrum lines is found to be of a various nature. The effective impact ranges determining the broadening of the Raman lines are found. For the Q branch of the vibrational band $\rho_\nu = 0.43$ A and for the pure rotational band $\rho_\omega = 3.9$ A. It is shown that the results of the experiments do not contradict the impact theory of spectral line broadening. (auth)

16381

POLARIZATION OF COBALT AND IRON NUCLEI IN FERROMAGNETICS. B. N. Samoilov, V. V. Sklyarevskii, and E. P. Stepanov. Zhur. Eksptl'. i Teoret. Fiz. 36, 1366-7(1959) May. (In Russian)

The anisotropy of the γ radiation from Co^{60} in a magnetized cobalt-iron alloy (permendure) was measured. The measurements were carried out in the temperature range from 0.03 to 0.1°K. The magnetic field strength on the cobalt nucleus is obtained, $H = 2{,}5 \cdot 10^5$G. No γ-ray anisotropy was detected in similar experiments carried out with Fe^{59} nuclei in Armco iron cooled down to 0.02°K. (auth)

16382

STABILITY OF AN IDEALLY CONDUCTING LIQUID FLOWING BETWEEN ROTATING CYLINDERS IN A MAGNETIC FIELD. E. P. Velikhov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1398-1404 (1959) May. (In Russian)

Sufficient conditions for the stability of an ideal liquid flowing in axial and toroidal fields are derived. Critical values of the magnetic fields which stabilize the flow are obtained and a physical interpretation of the results is presented. (auth)

16383

CHARGED PARTICLE ENERGY LOSSES DUE TO EXCITATION OF PLASMA OSCILLATIONS. Yu. L. Klimontovich (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1405-18(1959) May. (In Russian)

Beam electrons and plasma oscillations are considered as two sub-systems. A kinetic equation describing the interaction between the beam and plasma is obtained under the assumption that the beam does not change its properties and that the plasma state is specified by its equilibrium characteristics. The expression for the deceleration force calculated on basis of this formula includes losses due to electron-electron collisions as well as those due to excitation of plasma oscillations. A more general case is considered when neither of the sub-systems is in a state of thermal equilibrium. The solution of a set of nonlinear equations for the beam electron distribution function and electric potential is considered for this particular case. The results obtained are used to explain the effect of rapid energy transfer from the beam electrons to the plasma electrons first observed by Langmuir. (auth)

16384

ON THE PHENOMENOLOGICAL THEORY OF THE VOIGT EFFECT IN PARAMAGNETICS. L. M. Tsirulnikova (Perm State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1428-34(1959) May. (In Russian)

A macroscopic calculation of the Voigt effect in paramagnetic media is presented for centimeter waves. (auth)

16385

NON-RELATIVISTIC SOLUTION OF THE BETHE—SALPETER EQUATION. A. I. Alekseev (Moscow Inst. of Tech. and Physics). Zhur. Eksptl'. i Teoret. Fiz. 36, 1435-7(1959) May. (In Russian)

A non-relativistic solution of the Bethe—Salpeter equation was obtained with account of terms of the same order as the relative velocity of the particles. (auth)

16386

RESONANCE SCATTERING OF LOW ENERGY γ-QUANTA ON NUCLEI. B. N. Kalinkin (Lebedev Inst. of Physics, Academy of Sciences, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1438-42(1959) May. (In Russian)

The mechanism of resonance scattering of low energy γ quanta on nuclei is discussed. It is shown that it is of the nature of resonance nuclear fluorescence and that excitation of the nucleus can be described with aid of single-nucleon transitions. The γ-ray scattering cross sections are calculated on basis of the shell theory. The width of the excited level was estimated by using the Fermi gas model and the results of the investigations of Signell and Marshak on the theory of scattering of nucleons. The results are in satisfactory agreement with the experimental data. (auth)

16387

ON PENETRATION OF AN ELECTROMAGNETIC FIELD IN A PLASMA. K. N. Stepanov (Inst. of Physics and Tech., Academy of Sciences, Ukrainian S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1457-60 (1959) May. (In Russian)

The depth of penetration of an electromagnetic field into a semi-infinite plasma located in a magnetic field perpendicular to the plasma boundary is calculated. (auth)

16388

CAUSALITY IN THE THEORY WITH AN INDEFINITE METRIC. D. A. Slavnov and A. D. Sukhanov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1472-9 (1959) May. (In Russian)

The possibility of setting up a unitary and macroscopic scattering matrix in the theory with an indefinite metric is discussed. The matrix is constructed within the framework of perturbation theory with aid of a Lagrangian interaction of complete(physical plus sum of non-physical) fields. By a special choice of the non-physical field spectrum it was possible to satisfy the unitarity and macro-causality requirements in the second and third orders. However, it was possible to satisfy simultaneously both of these requirements in the fourth order. This means that under the assumptions made above it is not possible to construct a unitary and macro-causal scattering matrix in a theory with an indefinite metric. (auth)

16389

ON THE DOPPLER EFFECT IN AN ANISOTROPIC AND GYROTROPIC MEDIUM. K. A. Barsukov (Lebedev Inst. of Physics, Academy of Sciences, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1485-91(1959) May. (In Russian)

The Doppler effect from an oscillator moving along the axis of a gyrotropic and anisotropic crystal is considered. Some general formulas for the radiation energy were obtained from which, in particular, formulas for the Cherenkov radiation of a charge and a dipole can be derived. A number of peculiarities of the radiation in an anisotropic gyrotropic medium is investigated. (auth)

16390

ON THE ROLE OF VISCOSITY IN THE HYDRODYNAMICAL THEORY OF MULTIPLE PARTICLE FORMATION. A. A. Emelyanov (Lebedev Inst. of Physics, Academy of Sciences, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1550-4(1959) May. (In Russian)

The model of a viscous ultrarelativistic fluid is employed to describe the emission of the meson-nucleon cloud produced in the collision of high energy nucleons. An asymptotic solution of the one-dimensional equations was obtained. It is shown that account of viscosity leads to a less pronounced anisotropy in the angular distribution of the secondary particles than if an ideal fluid is considered. (auth)

16391

REFINEMENT OF THE THOMAS–FERMI MODEL AT SMALL DISTANCES. E. S. Fradkin (Lebedev Inst. of Physics, Academy of Sciences, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1533-5(1959) May. (In Russian)

A correction to the Thomas–Fermi model is suggested for small distances from the nucleus which leads to a significant improvement between the calculated and experimental values for the total energy of the atoms. (auth)

16392

STRUCTURE OF A MAGNETO-HYDRODYNAMIC SHOCK WAVE IN A PARTIALLY IONIZED GAS. S. B. Pikelner (Crimean Astrophysical Observatory, Academy of Sciences, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1536-41(1959) May. (In Russian)

A magnetohydrodynamical shock wave in a partially ionized gas consists of a thin plasma discontinuity and a transition zone. An approximate solution of the equations for the transition zone is carried out for some particular cases. The charge exchange effect does not significantly influence the general nature of the motion but decreases the scale. As long as the wave can be considered stationary within the transition zone the magnitude of energy dissipation is independent of the degree of ionization. (auth)

16393

SOME APPLICATIONS OF THE METHOD OF SUMMATION OF THE MAIN FEYNMAN DIAGRAMS IN THE THEORY OF METALS. Yu. V. Tsekhmistrenko (Inst. of Physics, Academy of Sciences, Ukrainian, S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1546-9(1959) May. (In Russian)

On the basis of the condition of smallness of the mean phonon energy as compared with the mean electron transition energy, a Hamiltonian involving direct electron-electron interaction is set up which, in the indicated approximation, describes a Fröhlich system of interacting electrons and phonons. (auth)

16394

ON QUANTIZATION OF HALF-INTEGER SPIN FIELDS. D. V. Volkov (Inst. of Physics and Tech., Academy of Sciences, Ukrainian, S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1560-6(1959) May. (In Russian)

A half-integer spin wave field quantization scheme is considered which is different from the usual one with anticommutators and is consistent with the principle of relativistic causality, positiveness of the energy (for noninteracting fields), with the Lagrangian formalism in Schwinger's formulation, and with invariance under CPT transformations. The main difference between the scheme under consideration and the usual one is that the maximal occupation number is two. (auth)

16395

METHOD FOR ESTIMATING THE IDEAL GAS IONIZATION AND THERMODYNAMIC FUNCTIONS IN THE MULTIPLE IONIZATION REGION. Yu. P. Raizer. Zhur. Eksptl'. i Teoret. Fiz. 36, 1583-5(1959) May. (In Russian)

A method is suggested for estimating the degree of ionization and thermodynamic functions of any gas. The method produced accurate results for very low degrees of ionization. (R.V.J.)

16396
POLARIZATION TENSOR IN BORN APPROXIMATION. L. D. Puzikov and Ya. A. Smorodinskii. Zhur. Ekslptl'. i Teoret. Fiz. 36, 1585-6(1959) May. (In Russian)

The polarization of elastically scattered nucleons previously calculated in the first Born approximation equals zero. The polarization of particles with higher spins is calculated in Born approximation considering the Hermitian scattering amplitude. (R.V.J.)

16397
ON THE POSSIBILITY OF DETERMINING THE POTENTIAL OF PLASMA SPACE BY THE CHARACTERISTICS OF THE NOISE EXCITED IN GAS DISCHARGE. A. A. Zaitsev, M. Ya. Vasil'eva, and V. N. Mnev (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1590-1 (1959) May. (In Russian)

The plasma space potential was determined in cylindrical, gas filled tubes with hot cathodes. The noises in the probe-cathode area were measured with an interference recorder of IP-12 M type. The experiments were made with krypton gas at 0.01 to 1 mm mercury pressure with discharge currents from 6 to 140 ma. The noise method produced good results in cases where the probe method does not succeed in measuring the discharge parameter. (R.V.J.)

16398
ON THE TEMPERATURE DEPENDENCE OF FERROMAGNETIC RESONANCE IN YTTRIUM FERRITE GARNETS. L. A. Malevskaya and G. M. Nurmukhamedov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1600-1(1959) May. (In Russian)

The temperature dependence of the ferromagnetic resonance absorption line, g factor, and resonance field in polycrystalline yttrium ferrite garnets in which the Fe^{3+} ions were replaced by Al^{3+} and Cr^{3+} ions was studied. The temperature dependence of the spontaneous magnetization was also measured in $3Y_2O_3 \cdot 5Fe_2O_3$, $3Y_2O_3 \cdot 4Fe_2O_3 \cdot Al_2O_3$, and $3Y_2O_3 \cdot 4.5Fe_2O_3 \cdot 0.5Cr_2O_3$. At the Curie point the spontaneous magnetization drops sharper than the ΔH. Furthermore, in the stoichiometric ferrite $3Y_2O_3 \cdot 5Fe_2O_3$ the σ_s and ΔH drops faster than in replaced ferrites. At the Curie point the $H\rho$ increases and the g factor decreases for $3Y_2O_3 \cdot 5Fe_2O_3$ and $3Y_2O_3 \cdot 4.5Fe_2O_3 \cdot 0.5Cr_2O_3$ stoichiometric ferrites. (R.V.J.)

16399
ELECTRIC FIELD IN MICROWAVE PLASMA AS FUNCTION OF TIME. V. E. Mitsuk and M. D. Kozminykh (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1603-4(1959) May. (In Russian)

The process of pulsed high-frequency discharge is investigated from the sparking point to the stabilized state when the electron density of the electric field and other parameters take on stationary values inherent to continuous generation. The time behavior of the electric field at certain stationary conditions was measured in deuterium and the obtained data plotted. (R.V.J.)

16400
A COMPLETE EXPERIMENT WITH β DECAY. Ya. A. Smorodinskii (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1606-8 (1959) May. (In Russian)

A necessary number of experiments ("a complete experiment") for restabilizing the nucleon-nucleon scattering matrix was determined previously. The results were subsequently generalized for arbitrary spin in particle collisions and for inelastic processes. A similar problem is resolved for β decay. (R.V.J.)

16401
MANUAL FOR THE DESIGN OF FERROUS AND NONFERROUS PRESSURE VESSELS AND TANKS. Sixth Edition. Karl Siemon. Ann Arbor, Mich., Edwards Brothers, Inc., 1958. 276p.

An analysis of various aspects of elements entering into pressure vessel design is presented. In addition, a discussion of suggested methods for stress calculation is given, as well as discussions of the physical properties and fabricating characteristics of the different metals. (J.R.D.)

Elementary Particles

16402 AERE-M/R-2857
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
NEUTRON DIFFRACTION AND SCATTERING. Three papers presented at the Second Colloquium of the U.K.A.E.A. Diffraction Analysis Conference held at the London Office, November 26, 1958. G. E. Bacon, ed. Mar. 1959. 56p. $1.26(BIS).

Three papers on the use of beams of thermal neutrons for studying the solid state are presented. A general introduction to neutron diffraction work is given, and some of the advantages over x-ray diffraction are discussed. In neutron inelastic scattering the particular value of measurements with neutrons is explained, and examples of experimental results obtained thus far are given. Experimental techniques and apparatus are discussed, and setups at DIDO, BEPO, and PLUTO are illustrated. (W.D.M.)

16403 AFOSR-TN-59-332
California. Univ., Berkeley.
INELASTIC FINAL-STATE INTERACTIONS: K^- ABSORPTION IN DEUTERIUM. Robert Karplus and Leonard S. Rodberg. [1959]. 54p. Contract AF49 (638)-327. (AD-213853).

In a reaction from which several strongly interacting particles emerge, it is often possible to isolate the effects of forces between two of the outgoing particles. There are many cases in which this final-state interaction can produce inelastic reactions. The formalism that describes this situation is developed, and the reaction $K^- + D \rightarrow \pi + \Sigma + N \rightarrow \pi + \Lambda + N'$ is studied in detail as an example. It is found that large Λ/Σ branching ratios can result and can be used to restrict the Σ-N and K-N interaction parameters. The gross features of the spectrum can be understood using a simple model. It does not seem possible to determine the parities of the strange particles from the momentum spectra. When the inelastic reaction in the final state is exothermic, as in the example, high partial waves may contribute. (auth)

16404 JEN-21
Spain. Junta de Energia Nuclear, Madrid.
ZUR THEORIE DER SONDENSTORUNGEN IM NEUTRONENFELD. (Theory of Probe Perturbations in the Neutron Field.) M. A. Vigon and K. Wirtz. 1956. 13p.

A probe decreases the density of inclosing neutron fields. The indications given by the probe are therefore too small, and neighboring probes are disturbed.

A correction must be applied to the probe results. These corrections are calculated by means of elementary diffusion theory, both for spherical probes and for finite expanding and infinite circular disk probes. (tr-auth)

16405 NP-7646
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
ON THE RATIO OF PHOTONS TO ELECTRONS IN EXTENSIVE AIR SHOWERS OF COSMIC RADIATION FOUND FROM ANALYSIS OF THE TRANSITION CURVE. Report No. 75/VI. J. M. Massalski and A. Oleś. Mar. 1959. 13p.

An analysis is made of the transition curve for particles of extensive air showers of cosmic radiation, at an altitude of 2636 m above sea level. The existing disparity between the experimental photon-to-electron ratio (p/e) and theory is explained. In accordance with the predictions of the theory a large number of photons were found with energies below the threshold energy of apparatus for registering electrons. The photon-to-electron ratio found for a threshold energy for electrons of 15 Mev, for photons of 15 to 30 Mev, $p/e = 1.0 \pm 0.1$ (only the statistical error is given) is below the actual value owing to the influence of the low-energy photons in the transition curve. (auth)

16406 NP-7701
European Organization for Nuclear Research, Geneva.
PION-HYPERON SCATTERING. INFLUENCE OF NON-SYMMETRIC Λ AND Σ INTERACTION. D. Amati, A. Stanghellini, and B. Vitale. May 1959. 15p.

A field theoretical model is developed in order to study the low-energy pion scattering on Λ or Σ hyperons, taking into account the Λ-Σ mass difference and possible inequality of the coupling constants. From the results it is possible to study the corrections to the prediction of a theory in which Λ and Σ are considered degenerate with respect to pion interactions. These corrections are of the order of the hyperon mass difference over the pion energy and can shift the possible resonances in an appreciable way. It is also briefly discussed which states can present resonances for particular choices of the coupling constants. (auth)

16407
FURTHER STUDIES OF COSMIC RAY BURSTS WITH SOLAR ACTIVITY. S. L. Malurkar (Colaba Observatory, Bombay). Acta Phys. Acad. Sci. Hung. 9, 353-68 (1959).

Among the upper air observations of cosmic ray intensity, Pomerantz after a preliminary choice selected nine instances to relate to solar flares, giving corresponding radio data and reproducing the cosmic ray records. As these were events described in some detail, it was considered desirable to examine them with reference to the evolution of corresponding solar active regions. As evolution of the region was considered, the use of available solar magnetic data previous and subsequent to the actual flares would be unobjectionable. Solar magnetic data were also available for one of the five very large solar flares connected with cosmic ray bursts and allowed good comparison. The examination indicates no modification of the conclusions drawn earlier. (auth)

16408
THRESHOLD BEHAVIOR OF CROSS SECTIONS OF CHARGED PARTICLES. Luciano Fonda and Roger G. Newton (Indiana Univ., Bloomington). Ann. Phys. (N. Y.) 7, 133-45(1959) June.

The energy dependence of scattering and reaction cross sections at the threshold of a new channel with Coulomb forces is investigated. In the case of opposite charges an anomaly is found in which the average over the Coulomb bound state resonances below the threshold energy is discontinuously different from the limit from above. The resolution and precision necessary, however, make it very difficult to measure the phenomenon. (auth)

16409
MESON KINEMATICS IN STATIC SOURCE MESON THEORIES. Francis R. Halpern (Princeton Univ., N. J.). Ann. Phys. (N. Y.) 7, 146-53(1959) June.

A method is given for constructing creation operators for many meson states in static source meson theories. These states will be diagonal in the angular momentum and isotopic spin, and they will form the bases for irreducible representations of the permutation group. The states for up to four mesons and for the angular momentum and isotopic spin equal to either zero or one are explicitly given in the case of symmetric pseudoscalar meson theory. (auth)

16410
THE PHYSICAL NUCLEON IN STATIC SOURCE MESON THEORY. F. R. Halpern and L. Sartori (Princeton Univ., N. J.); K. Nishimura (Rutgers Univ., New Brunswick, N. J.); and R. Spitzer (Columbia Univ., New York). Ann. Phys. (N. Y.) 7, 154-73(1959) June.

A wave function for the physical nucleon in static source meson theory was constructed by the method of moments. The wave function includes contributions from states containing as many as five mesons and is shown to be a good approximation to the ground state of the Hamiltonian. Because of the restrictive nature of the static model, the probability that the meson cloud have a particular angular momentum or isotopic spin turns out to be almost independent of the dynamics of the system. Since the matrix elements of the nucleon spin and isotopic spin operators can be expressed in terms of these probabilities, such matrix elements are determined essentially by the kinematics of the meson cloud. This fact renders unreliable any predictions of the static model which depend on matrix elements of the nucleon operators. The consistent failure of the static model to explain satisfactorily the scalar part of the magnetic moment may be ascribed to this cause. The quantities which depend on meson operators are more closely related to the dynamics of the system. The vector part of the magnetic moment is in agreement with experiment, and the electron-neutron interaction turns out much too large; these results differ little from those obtained by the Chew—Low one-meson approximation. However, the contributions of the many meson states are not negligible, and the mean number of mesons is found to be closer to two than to one. Evaluation of the charge renormalization allows a test of the scattering amplitudes predicted by the static model against the sum rules of Cini and Fubini. It is found that, for the conventional value of renormalized coupling constant, the sum rules are strongly violated. This result, together with the substantial many meson component of the wave function, casts doubt on the validity of the one-meson approximation in the static model. (auth)

16411
ELECTRON INTERACTIONS. PART I. FIELD THEORY OF A DEGENERATE ELECTRON GAS. D. F. DuBois (California Inst. of Tech., Pasadena). Ann. Phys. (N. Y.) 7, 174-237(1959) June.

The method of Gell-Mann and Brueckner for treating electron interactions in a degenerate electron gas is generalized using the Feynman–Dyson techniques of field theory. A Feynman propagator is constructed for the effective interaction between electrons which takes into account the polarizability of the medium of unexcited particles in the Fermi sea. The well-known plasmon excitation appears as a singularity in this propagator. The plasmon is seen to be a correlated, resonant oscillation of the electron density field which is damped by transferring its energy to less correlated, multiple excitations. General expressions for the plasmon dispersion relation and for the plasmon level width are derived in terms of the polarizability of the many-body medium. The self-energies of the lowest states of the electron gas are discussed by using the adiabatic theorem. This enables one to derive an exact expression for the ground state energy in terms of the polarizability. A formal calculation of the ground state energy to third order in the inter-electron spacing is carried out. Because of the degeneracy of the excited states of the noninteracting system, the adiabatic transforms of these states are not stationary states of the interacting system. However, as the momenta of the excited particles approach the Fermi momenta these states become asymptotically stationary. For states with only a few excited particles present an independent particle model is valid with the result that only the Feynman propagator for the physical one-particle state is needed. This propagator, which is corrected for the virtual polarization of the medium by the particle, provides all the information concerning the energies and damping of the single particle states. (auth)

16412

PRODUCTION OF ELEMENTARY PARTICLES IN THE LABORATORY. W. Paul (Universität, Bonn). Naturwissenschaften 46, 277-83(1959). (In German)

A survey of the operation and characteristics of the synchrotron and the synchrocyclotron is made. The production of mesons and hyperons by photoproduction, nucleon collision, and from π mesons is reviewed. (J.S.R.)

16413

THE PROPERTIES OF LIGHT AND HEAVY MESONS. W. Gentner (CERN, Geneva). Naturwissenschaften 46, 283-9(1959). (In German)

A brief review is given of the properties of light and heavy mesons. Detection methods, production, life time and decay schemes, mass, interactions, mesonic atom, fusion, and heavy mesons are considered. (J.S.R.)

16414

ELEMENTARY PARTICLES IN COSMIC RADIATION. E. Schopper (Institut für Kernphysik, Frankfurt am Main). Naturwissenschaften 46, 290-5(1959). (In German)

A survey is given of the detection and properties of elementary particles in cosmic radiation. The measuring methods, K mesons and hyperons, antiparticles, and laboratory experiments are considered. 20 references. (J.S.R.)

16415

METHOD FOR CHECKING ENERGY OF ACCELERATED ELECTRONS. V. A. Campanile and Charles D. Wagner (Shell Development Co., Emeryville, Calif.). Nucleonics 17, No. 7, 74(1959) July.

In using electron accelerators in radiation chemistry, it is important to have an accurate knowledge of the electron beam energy. A method is described that depends on the variation of electron penetration with energy. It is simple to use, yet accurate to within 5%. The apparatus is not only applicable to the Van de Graaff but can also be used with other accelerators. (A.C.)

16416

INVESTIGATION ON THE EXISTENCE OF PARTICLE WITH MASS AROUND 550 m_e IN COSMIC RADIATION. M. Conversi, G. M. De Munari, A. Egidi, E. Fiorini, S. Ratti, C. Rubbia, C. Succi, and G. Torelli (Universita, Milan and Pisa, Italy and Istituto Nazionale di Fisica Nucleare, Milan and Pisa, Italy). Nuovo cimento (10) 12, 148-55(1959) Apr. 16. (In Italian)

The results are reported of a cosmic ray experiment carried out at an altitude of 2550 m to search for the 550-mass particles reported by Alihanian et al. No event was found out of 25 expected on the basis of the rate reported. This negative result is compared with the results of other workers. The possibility for pions and protons to appear as 550-mass particles when undergoing unidentified interactions is discussed. (auth)

16417

NOTE ON PARITY VIOLATION IN STRONG INTERACTIONS. B. d'Espagnat and J. Prentki (CERN, Geneva). Nuovo cimento (10) 12, 164-6(1959) Apr. 16.

While parity is conserved to a high degree in nuclear phenomena, recent experimental work indicates that parity might be violated in strong interactions involving strange particles. An investigation was made to determine whether a strong parity violation in strange particle productions or interactions could be reconciled with some very weak and as yet unobserved parity violations. Calculations along these lines have not been done. An alternative approach to the problem is suggested. (A.C.)

16418

NUCLEAR SCATTERING OF HIGH ENERGY ELECTRONS. E. Predazzi (Università, Turin and Istituto Nazionale di Fisica Nucleare, Turin). Nuovo cimento (10) 12, 177-80(1959) Apr. 16.

Numerical calculations show that in order to know the differential cross sections at large angles, an exact evaluation of the single partial wave phase shifts is needed. The theoretical interpretation of measured cross sections raises the problem of giving the partial wave phase shifts by means of a compact analytical form. A direct and simple approach to the problem is presented, making use of a suitable simplification of the well known W.K.B. method. Electrons are still considered Klein-Gordon particles. (A.C.)

16419

CLOUD-CHAMBER MEASUREMENT OF THE HALF-LIFE OF THE NEUTRON. N. D'Angelo (Argonne National Lab., Lemont, Ill.). Phys. Rev. 114, 285-92 (1959) Apr. 1.

The half-life of the free neutron has been measured by a cloud-chamber method. It turned out to be 12.7 min with an error of ~15%, ~10% being due to the poor statistics. This determination has about the same accuracy as the best previous measurement and confirms it by an independent method. (auth)

16420

MASS OF THE CHARGED Σ HYPERONS. M. S. Swami (Univ. of Wisconsin, Madison and Tufts Univ., Medford, Mass.). Phys. Rev. 114, 333-5(1959) Apr. 1.

Twenty-nine examples of Σ^+ hyperon decays at rest into protons were used to determine the mass of the Σ^+

hyperon. The stopping power for each batch of emulsions containing these events was determined by making use of μ^+-meson ranges obtained from the decay of π^+-mesons at rest. The mean range of protons from Σ^+ decays was found to be 1686.5 ± 6.0 microns. The rms deviation was 37.2 ± 6.0 microns. The Q value for the decay ($\Sigma^+ \rightarrow p + \pi^0$) was found to be 116.37 ± 0.4 Mev and the mass of the Σ^+ hyperon, $(2328.1 \pm 0.8)m_e$. An analysis of three collinear events, which resulted from the interaction of stopped K^- mesons with hydrogen nuclei of the emulsion, gave the Σ^- hyperon mass to be $(2341.6 \pm 2.0)m_e$ and the mass difference between Σ^- and Σ^+ hyperons $(13.5 \pm 2.0)m_e$. (auth)

16421

POSITRON SPECTRUM FROM THE DECAY OF THE μ MESON. Walter F. Dudziak, Ryokichi Sagane, and James Vedder (Univ. of California, Berkeley). Phys. Rev. 114, 336-58(1959) Apr. 1.

A magnetic spiral-orbit spectrometer was used to study the positron spectrum from an isotropic μ^+ decay. The detected positrons were identified by an electronic technique designed to measure the lifetime of the muon. The measured weighted mean value of the μ^+ mean life is $\tau_\mu = 2.21 \pm 0.02$ μsec. The data have been analyzed according to the simplified one-parameter theory of Michel, as modified by Behrends, Finkelstein, and Sirlin and corrected by Berman to include radiative corrections to the muon decay theory. The value $\rho_M = 0.741 \pm 0.027$ was obtained for the Michel parameter as the weighted mean value from four experiments. In these experiments the measurements in the low-energy positron region were not of sufficient accuracy to yield an estimate of the second Michel parameter. Included is a measurement of the maximum positron energy. The weighted mean value of this measurement is W = 52.87 ± 0.07 Mev. From this value and its simple algebraic relation to the masses of the decay particles one obtains a value of the μ^+ mass $\mu = 206.94 \pm 0.27$. Tables of the radiative correction to muon decay are given as well as the total corrections that must be added to the Michel parameter that is derived from experimental data by using the simple Michel theory without radiative corrections. For the energy region of the majority of experiments from which the ρ_M value is determined, this total correction in $\Delta\rho$ is approximately 0.040. From the measured value of the maximum positron energy, an estimate is made of the possible upper limit on the mass of the neutral particle in muon decay. This upper limit is reported as 8 electron-mass units. (auth)

16422

LIFETIMES AND DECAY SPECTRA OF τ'^+ AND $K^+_{\mu3}$. S. Taylor, G. Harris, J. Orear, J. Lee, and P. Baumel (Columbia Univ., New York). Phys. Rev. 114, 359-64 (1959) Apr. 1.

Nuclear emulsion stacks were exposed to the Bevatron ~360-Mev/c unseparated K^+ beam at two different distances from the target. The K_L to τ' and K_L to $K_{\mu3}$ ratios at the two positions, combined with the known K_L lifetime, yield $(1.0_{-0.3}^{+0.5}) \times 10^{-8}$ sec for the τ' mean life and $(1.2_{-0.4}^{+1.0}) \times 10^{-8}$ sec for the $K_{\mu3}$ mean life. These lifetimes, when compared with other K^+ lifetimes, are consistent with a single lifetime for all K^+ mesons. The π^+ energy spectrum from τ'^+ decay is obtained, using 72 events, and by Dalitz-type analysis is found to be consistent with spin zero but would be unlikely for spin one. Hence, the τ' spin is consistent with being the same as that of the τ. The μ^+ energy spectrum from $K^+_{\mu3}$ decay is obtained from 0 to 63 Mev, using 47 events, and is found to be consistent with the energy distribution of the density of final states in the region. The relative abundances of τ^+, τ'^+, and $K^+_{\mu3}$ are found to be 0.052 ± 0.003, 0.015 ± 0.002, and 0.028 ± 0.004, respectively, the $K_{\mu3}$ abundance having been estimated by assuming that the μ^+ spectrum above 63 Mev is proportional to the density of final states. (auth)

16423

ELEMENTARY PARTICLES IN A FINITE WORLD GEOMETRY. H. R. Coish (Univ. of Manitoba, Winnipeg, Can.). Phys. Rev. 114, 383-8(1959) Apr. 1.

To account for the elementary particles a new physical geometry may be needed. A previous suggestion that this geometry may be finite is followed up by determining the representations of the orthogonal (Lorentz-like) group. Because of the existence of a new type of orthogonality-preserving transformation some of the representations are multiple-valued. A change of value is identified with a gauge transformation and electric charge is recognized as a certain number determining the many-valuedness of the representation. This charge number reverses sign under space inversion. The charged pions and sigma particles are correlated with some of the new representations. (auth)

16424

NEW INTERPRETATION OF HYPERONIC CHARGE AND ITS GENERALIZATION TO LEPTONS. Takao Okabayashi (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 20, 583-613(1958) Nov.

All weak interactions are assumed to violate the conservation law of parity, contrary to the case of strong interactions. Such correlation between two conservation laws of parity and of hyperonic change can be achieved by a new interpretation of hyperonic charge. The phenomenological hyperonic charge is expressed by the expectation value of a new operator, $\zeta_2\gamma_5$. Nucleons and Ξ particles are assumed as the eigenstates of this operator, and two τ-spin doublets recombined from Λ and Σ particles are assumed as the eigenstates of $\zeta_3\gamma_5$, which anticommutes with $\zeta_2\gamma_5$. If the suitable ζ dependence is assigned to the tensor matrices associated with K and π mesons, the correlation mentioned above can be derived. In the course of the construction of the scheme, the problems of the so-called particle mixture and of the particle image under the coexistence of the parity-conserving and nonconserving interactions are used as the stepping stones. The introduction of the new matrix ζ and the ζ dependence of the tensor matrices associated with bosons allow us to assign the generalized hyperonic charge to leptons, and to exclude the unwanted processes, $\pi \rightarrow e + \nu$, $(K \rightarrow e + \nu)$ and $P + \mu \rightarrow P + e$, owing to the assignment. The connection of the scheme and the interpretation that hyperonic charge can be understood as the parity in isotopic spin space suggests some internal correlation between the Minkowski space and the isotopic spin space. The possibility of such correlation is discussed. The spinor analysis in the six dimensional space, which partly reproduces the obtained results, is described as a tentative model. (auth)

16425

ON THE ABSORPTIVE RANGE IN THE PION-NUCLEON COLLISION AT HIGH ENERGIES. Kin-ichi Ishida (Yamagata Univ., Japan). Progr. Theoret. Phys. (Kyoto) 20, 774-5(1958) Nov.

Recent experiments on pion-nucleon collision at high energies are described. An investigation is made of the absorptive range from the standpoint of the π-π interaction model. (A.C.)

16426

MOLECULAR PROCESSES INDUCED BY μ^- MESONS IN HYDROGEN BUBBLE CHAMBER. [PART] I. TRANSFER PROCESS OF μ^- MESON FROM PROTON TO DEUTERON. M. Shimizu, Y. Mizuno, and T. Izuyama (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 20, 777-9(1958) Nov.

An investigation of the μ^- transfer process from a proton to a deuteron when a μ^- meson proton collides with a deuteron with very low incident energy is reported. Estimation of the reaction time has been previously attempted. The values of the reaction time are spread over a wide range. A calculation is described which stands on a sounder basis than previous methods and is expected to give a better result. The reaction time found by this calculation together with those of other authors is tabulated. (A.C.)

16427

ABSORPTION EFFECTS IN ANTINUCLEON PHENOMENA. II. Y. Kakudo, T. Kammuri, and R. Nakasima (Osaka Univ. and Osaka City Univ.). Progr. Theoret. Phys. (Kyoto) 20, 779-81(1958) Nov.

Absorption effects in antinucleon production processes were previously considered. It was found that experimental results can be reproduced fairly well in the case of antiproton production by taking account of the effects of intranuclear motion and the reabsorption of antiprotons produced. In the case of antineutron production by charge exchange of antiprotons, however, desired agreement with the experiments was not obtained by taking into account only the absorption and reabsorption effects. An attempt is made to remove the discrepancy using an improved model. (A.C.)

16428

A THEORY OF CLOTHED UNSTABLE PARTICLES. II. Noboru Nakanishi (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 20, 822-34(1958) Dec.

The physical state of unstable particles previously proposed is derived as the state produced in a finite time interval on the basis of the scattering theory of Gell-Mann and Goldberger. Also, the exact state is obtained from the physical state by employing an appropriate limiting process. An S-matrix-theoretical calculation method is proposed for the processes including unstable particles. (auth)

16429

THE DISPERSION RELATION AND THE PION-NUCLEON INTERACTION CROSS SECTION AT VERY HIGH ENERGIES. Tetsuro Sakuma, Shinya Furui, and Akira Kanazawa (Hokkaido Univ., Sapporo). Progr. Theoret. Phys. (Kyoto) 20, 835-43(1958) Dec.

Using dispersion relations, the sum of the total cross sections for the π^+-p and π^--p interactions are evaluated at very high energies, under the assumption that the cross sections are constants above a certain very high energy. The numerical value of the sum of the cross sections is determined mainly from empirical data at low energies (less than 2 Bev). The analysis gives a sum of the cross sections a few times larger than the geometrical cross section obtained by assuming that the "radius" of the nucleon is the pion Compton wavelength. Since the dispersion relations seem to be consistent with experiments at low energies, this strongly suggests that the dispersion relation would break down at very high energies. (auth)

16430

AN ANALYSIS OF EXPERIMENTAL DATA ON EXTENSIVE AIR SHOWERS. Saburo Miyake (Osaka City Univ.). Progr. Theoret. Phys. (Kyoto) 20, 844-56 (1958) Dec.

Fluctuations in the starting points of extensive air showers were investigated. A method of obtaining the shower curve without taking into account the effect of the fluctuations is presented. The use of such a method results in small energy showers, which thrust themselves into the lower atmosphere; being observed as if they were large energy showers. This may modify the primary energy spectrum in such a way that the intensity at very high energies is significantly smaller than the one currently adopted. Qualitative interpretations of some unusual events and some speculations on high energy nuclear interactions are also given. (auth)

16431

MASS REVERSAL AND WEAK INTERACTIONS. Tadashi Ouchi (Univ. of Maryland, College Park). Progr. Theoret. Phys. (Kyoto) 20, 909-19(1958) Dec.

It is shown that special mass reversal MR(1) and MR(2) can be applied to both weak Fermi-type interactions and weak Yukawa-type interaction without any internal contradiction in the theory of MR(4) and MR(3) (for strong interactions). The selection rules obtained are consistent with experiment and suggest taking the universal Fermi interactions with V−A coupling as the primary interactions for all the lepton processes. The mass reversibility of the theory under MR(1) requires that the space parity is not conserved in all the weak interactions and that the mass of the neutrino must be exactly zero. MR(2) invariance allows only a linear combination of (AV) couplings when the coupling is independent of the explicit masses. It is assumed that leptons are conserved and are C or D type fields under mass reversal, guaranteeing the conservation of baryons automatically. From the requirement of MR (4) and the consistency of the theory, the neutrino is shown to be a mass parity doublet. It is shown from the application of mass reversal to the lowest order diagrams in g that the unwanted lepton processes are forbidden or explained even when the μ^-, e^-, and ν are taken as the particles. The prediction of the rarity of $\pi \rightarrow e + \nu$, $\pi \rightarrow e + \nu + \gamma$, and $K \rightarrow e + \nu$ is given by extending the universal interaction proposed by Huang and Low in such a way that it is invariant under mass reversal. If this is true, the neutrino must have four components in a strict sense, and in the usual experiments it is observed as if it were a two component field. If MR(3) is assumed to apply to Fermi interactions, it requires uniquely that the universal interactions have V−A coupling, and the helicity of the neutrino is −1. The decays $K \rightarrow (\pi) + \bar{\nu} + \nu'$ are shown to be ruled out by the mass parity conjugation invariance and MR(1), provided the leptons are C or D type fields under mass reversal. The mass parity is shown to be related closely to the strangeness, which is the important difference between this and Sakurai's theory. (auth)

16432

MESON PRODUCTION IN MESON-NUCLEON INTERACTION. S. K. Kundu (Indian Assn. for the Cultivation of Science, Calcutta). Progr. Theoret. Phys. (Kyoto) 20, 939-47(1958) Dec.

Meson production by mesons in the low-energy limit was re-examined within the framework of the statical model of extended source theory. Using Feynman's technique the calculation was performed up to fifth order in the coupling constant. The renormalization procedure is the same as that developed and applied by Chew in meson-nucleon scattering processes. To reduce the Feynman diagram, an approximation similar to that of Tamm-Dancoff was used. The total cross section for charged and neutral pions from pion-nucleon collisions in the $T = 3/2$, $J = 3/2$ state are obtained for incident meson energy 260 to 570 Mev. The theoretical results were compared with those of Franklin, Barshay, and others. Franklin's result, that production of charged pions is higher than that of neutral pions in the cut-off theory, is confirmed. The present calculation predicts charged pion production of about 7 mb at 500 Mev against the available experimental cross section of 10 mb at the same energy. (auth)

16433

SOME REMARKS ON THE SCATTERING PROBLEM. Masakuni Ida (Univ. of Kyoto). Progr. Theoret. Phys. (Kyoto) 20, 979-80(1959) Dec.

The validity of Levison's theorem on meson scattering in quantum mechanics is discussed. It is shown that the theorem loses its kinematical character. (A.C.)

16434

PROTON-PROTON SCATTERING IN THE Gev REGION. Criticism of the Blockhintsev-Bubelev Model. Junko Oba (St. Pauls Univ., [Tokyo]) and Tetsuo Goto (Nihon Univ., [Tokyo]). Progr. Theoret. Phys. (Kyoto) 20, 982-3(1958) Dec.

When Bubelev's cut-off parameter is used, the branching ratio of the production cross sections of one pion to two or more pions turns out to be larger than the experimental value. From a graphical study of experimental data it appears that the facts are in disagreement with Bubelev's model and that the contribution from the central collision can not be considered as negligible in the Bev region. (A.C.)

16435

ON THE ANALOGY BETWEEN STRONG INTERACTION AND ELECTROMAGNETIC INTERACTION. Yasunori Fujii (Nihon Univ., Tokyo). Progr. Theoret. Phys. (Kyoto) 21, 232-40(1959) Feb.

According to Sakata's composite hypothesis of heavy particles, the fundamental particles do not change their kind through strong interactions. A formulation of these interactions is given which requires invariance under the gauge transformation of the first kind for each baryon field. Assuming the phase function depends on the spacetime coordinate, this leads to the existence of a neutral vector meson analogous to the electromagnetic field, the mass of which need not always vanish. Its consequences are examined and found to be quite favorable for the interpretation of the strong interaction. In particular, it leads to the conservation law of parity in strong interactions and the condition for the existence of the composite state. (auth)

16436

PHOTOPRODUCTION OF LOW ENERGY CHARGED π-MESONS ON COMPOSITE NUCLEI. V. M. Popova, N. G. Semashko, and R. F. Yagudina (Lebedev Inst. of Physics, Academy of Sciences, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1357-9(1959) May. (In Russian)

The yield of 0 to 3 Mev charged photomesons at angles of 90° with respect to the photon beams were studied for Be, C, Al, and Cu nuclei. The maximum photon energy was 265 Mev. The dependence of the negative π meson yields and also the ratio of the positive and negative π meson yields on the atomic number were obtained. A comparison of the experimental results with the theoretical calculations of Baldin and Lebedev indicates that the mesons are produced on nucleons located on the surface of the nucleus. (auth)

16437

$K_2^0 \rightarrow K_1^0$ TRANSFORMATION ON ELECTRONS. Ya. B. Zeldovich. Zhur. Eksptl'. i Teoret. Fiz. 36, 1381-6 (1959) May. (In Russian)

The E0 transformation of K_2^0 into K_1^0 is considered for the case when these particles interact with electrons. The cross section of the process and angular distribution are estimated. Interference between the electron and nuclear interaction for $K_2^0 \rightarrow K_1^0$ transformation in the unscattered beam is examined. (auth)

16438

SCATTERING OF FAST π-MESONS ON DEUTERONS. A. G. Sitenko (Khar'kov State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1419-22(1959) May. (In Russian)

Shadow effects appearing in the diffractional scattering of fast π-mesons on deuterons are considered. (auth)

16439

DEPENDENCE OF THE MEAN ANGLE BETWEEN THE DIRECTION OF MOTION OF CASCADE SHOWER PARTICLES AND THE SHOWER AXIS ON THE DISTANCE OF THE PARTICLES FROM THE SHOWER AXIS. V. V. Guzhavin and I. P. Ivanenko (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1509-12 (1959) May. (In Russian)

The dependence of the mean angle between shower particles and the shower axis on the distance from the shower axis is computed. An electron-photon shower averaged over the depth is considered. Ionization losses are neglected. The results of the calculations are compared with the experiments. (auth)

16440

RADIATIVE CAPTURE OF POLARIZED μ-MESONS BY NUCLEI. G. M. Gandelman and V. N. Mokhov. Zhur. Eksptl'. i Teoret. Fiz. 36, 1513-16(1959) May. (In Russian)

The correlation between the direction of the μ-meson spin and the direction of the γ-quantum emitted in the radiative capture of the μ-meson by a nucleus is considered with account of the interaction between the μ meson and nuclear spins (hyperfine splitting). The analysis is carried out for nuclei of arbitrary spin I. (auth)

16441

A QUALITATIVE INTERPRETATION OF THE MEAN ELECTRON EXCITATION ENERGY IN ATOMIC COLLISIONS. O. B. Firsov. Zhur. Eksptl'. i Teoret. Fiz. 36, 1517-23(1959) May. (In Russian)

Transformation of the kinetic energy of relative motion of colliding particles into electron excitation energy is interpreted as being the result of their deceleration caused by electron exchange. Electron motion in the region of overlapping shells of the colliding particles is considered quasi-classically. It is assumed that when the electron moves from the potential field of one of the atoms to that of another it transfers from the first atom to the second a momentum which on the average is equal to the product of the relative velocity of the atoms on the mass of the electron. (auth)

16442

AZIMUTHAL SYMMETRY IN CASCADE OF REACTIONS AND PARITY CONSERVATION. M. I. Shirokov

(Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1524-32(1959) May. (In Russian)

Some angular azimuthal symmetry relations in cascade reactions of the proton triple scattering type are derived which follow from parity conservation. It is pointed out that experimental establishment of the simplest of these symmetries which is well known, namely symmetry of twice scattered particles relative to the plane of the first scattering, is not an exhaustive proof of parity conservation. The experiments suggested here are a more reliable proof of this law and in some cases it can be considered as a complete proof. (auth)

16443

SCATTERING OF DIRAC PARTICLES IN THE SECOND BORN APPROXIMATION. V. M. Arutyunyan and R. M. Muradyan (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1542-5(1959) May. (In Russian)

Elastic scattering of Dirac particles by a spherically symmetrical field of a fixed center is considered. The values of the scattering amplitudes are determined in the second Born approximation. (auth)

16444

ON THE DEPTH OF THE POTENTIAL HOLE FOR Λ PARTICLE IN HEAVY HYPERNUCLEI. V. A. Filimonov (Tomsk Polytechnic Inst.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1569-70(1959) May. (In Russian)

The potential of Λ interactions in nuclear matter was evaluated on the basis of the previously derived potentials (developed from meson theory). In the estimate the potentials of nucleons are considered as a noncompressible degenerate Fermi gas. The calculations were carried out for two nuclear densities described by the radii $R = 1.2A^{1/3} \times 10^{-13}$ and $1.4A^{1/3} \times 10^{-13}$. The magnitudes of Λ potential energies U^{1k}, $U^{2\pi}$, $U^{k\pi}$, and U^{2k} are tabulated for the Λ-nucleon potentials related to the exchange with one K, two π, K and π, and two K mesons and for the total potential U. The presented values were derived using the scalar and pseudoscalar assumption of K-meson bonds with baryons. (R.V.J.)

16445

ON THE POSSIBLE METHOD FOR DETERMINING THE DIRECTION OF μ^- MESON POLARIZATION. V. A. Dzhrbashyan (Inst. of Physics, Academy of Sciences, Armenian, S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1572(1959) May. (In Russian)

A formula is derived for describing the angular distribution of circularly polarized γ quanta at μ-mesoatom transition 2p → 1s. (R.V.J.)

16446

EFFECTS OF NUCLEON ISOBAR STATE ON THE ELECTRON-NEUTRON INTERACTION. G. A. Kharadze (Inst. of Physics, Georgian S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1577-8(1959) May. (In Russian)

The effects of isobar states on the electron-nucleon magnetic radius were estimated using time-ordered tri-vertex diagrams without fermion pairs and neglecting the isobar motion in the projection spin operator. Moreover, it was assumed that the nucleon and isobar have opposite internal parities. (R.V.J.)

16447

SPALLATION OF CHARGED PARTICLES BY NUCLEAR COULOMB FIELD. M. Z. Maksimov. Zhur. Eksptl'. i Teoret. Fiz. 36, 1582-3(1959) May. (In Russian)

The cross sections in processes of charged particle spallation by nuclear Coulomb fields were calculated using a classical approach analogous to the Thomson formula inference for atomic ionization by shock. The evaluations made with the obtained formulas show for deuterons $\epsilon_0 = 2.18$ at ~200 Mev and for beryllium $\epsilon_0 = 1.7$ at ~100 Mev; the cross sections are 1.4×10^{-28} Z^2 cm^2 and 0.45×10^{-28} Z^2 cm^2, respectively. The formulas can also be used for estimating the Coulomb spallation cross sections of H_2^+ and D_2^+ molecules assuming that $Z_1 \sim 1$, $Z_2 \sim 0$, $A_1 = A_2$, and $\epsilon_0 \approx 2.5$ ev at 20 to 30 kev; results show $\sigma \approx 10^{-18}$ Z^2 cm^2. (R.V.J.)

16448

ON ONE POSSIBILITY OF DETERMINING THE μ MESON POLARIZATION SIGN. S. A. Kheifets (Inst. of Physics, Academy of Sciences, Armenian S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1588(1959) May. (In Russian)

An experimental determination of the polarization sign in $\pi \to \mu$ decay was attempted in order to apply it to the solution of the light particle conservation law. (R.V.J.)

16449

ON SOME PROPERTIES OF ANTIPROTON ANNIHILATION ON DEUTERONS. E. O. Okonov (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1597-8(1959) May. (In Russian)

A process of single meson annihilation when part of the emitted energy in the annihilation is transmitted directly to the remaining nucleons ($\bar{p} + d \to p + \pi^-$; $\bar{p} + d \to n + \pi^0$) is analyzed. It was observed that in antiproton annihilation capture by deuterons, strange particle production reactions $\bar{p} + d \to \Sigma^- + K^+$, $\bar{p} + d \to \Sigma^0 + K^0$, and $\bar{p} + d \to \Lambda^0 + K^0$ take place in addition to $\bar{p} + d \to p + \pi^-$, $\bar{p} + d \to n + \pi^0$, and $\bar{p} + d \to n + \rho^0$. (R.V.J.)

16450

MODEL DESIGN OF p-p INTERACTIONS AT 10 Bev. G. I. Kopylov (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1598-1600 (1959) May. (In Russian)

A table of 200 accidental stars formed by p-p interactions at 10 Bev was developed previously in order to verify the method for modeling the processes of multiple production. The table considered processes producing 1 to 6 mesons according to the statistical theory and assumed the presence of isobars. Results from the analysis made of the stars are presented. The nucleon and meson spectra in the center of mass system and the proton and π^+ and π^- meson spectra in the laboratory system were found. The theoretical magnitudes of the stars were derived from the tables, and the angular distribution between the rays projected on the plane, normal to the interaction axis, was plotted. The analysis showed that with the increased number of prongs the statistical relation between the direction of the prongs becomes clearer. (R.V.J.)

16451

GENERAL FORMULA FOR THE ELECTROMAGNETIC SCATTERING OF TWO DIFFERENT PARTICLES WITH A SPIN ½. A. I. Nikishov (Lebedev Inst., Academy of Sciences, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1604-5(1959) May. (In Russian)

A formula derived for high-energy electron scattering is adapted for use in μ meson scattering on nucleons by a generalization of the mass of the incoming particle and by assuming that the particle possesses an internal structure described by certain form factors. (R.V.J.)

16452

ON THE POLARIZATION ASYMMETRY CORRELATION. S. M. Bilen'kii and R. M. Ryndin. Zhur. Eksptl'. i Teoret. Fiz. 36, 1609-10(1959) May. (In Russian)

The asymmetry and polarization correlation in scattering of relativistic particles was studied. Asymmetry measurements of random polarized beam scattering permits the determination of the standard, in relation to the scattering plane, component of the polarization vector space section. (R.V.J.)

16453

ELECTROMAGNETIC STRUCTURE OF PROTONS AND NEUTRONS. D. I. Blokhintsev, V. S. Barashenkov, and B. M. Barbashov (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1611-12(1959) May. (In Russian)

16454

UNIVERSAL FERMI INTERACTIONS AND ASTROPHYSICS. B. Pontekorvo (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1615-16(1959) May. (In Russian)

The existence of $\nu - e$ interactions of the first order which lead to macroscopic effects was analyzed. The positron–electron annihilation with neutrino–antineutrino pair emission can follow such interactions. Consequently, instead of photon emission, the emission of the $\nu - \bar{\nu}$ pair (through virtual pair e^+e^-) becomes possible. Such general basic bonds between electromagnetic phenomena and lepton processes follow from the Fermi universal interactions. Processes of electron bremsstrahlung with photon or $\nu - \bar{\nu}$ pair emission in electron collision with A nuclei of Z charge $e + A \rightarrow e + A + \gamma$ and $e + A \rightarrow e + A + \nu + \nu$ are studied. (R.V.J.)

Heat Transfer and Fluid Flow

16455 DGGW-EMR-58-9

Imperial Coll. of Science and Tech., London.

FLOW THROUGH POROUS MATERIALS. PART III. FLOWRATES AT COMMENCEMENT OF LIQUID FLOW THROUGH POROUS MATERIALS. P. Eisenklam and L. H. Ford. May 1958. 38p. (AD-204689).

There is a definite time lag before the equilibrium flowrate is reached when flow is commenced suddenly through an initially dry porous mass. For a given porous mass a plot of time lag versus pressure drop yields a straight line with a negative slope. The increase in permeability is linear during the time lag interval. There is a critical pressure drop for a given porous mass above which there is no finite time lag. For ½ in. thick glass and stainless steel with water as the fluid the time lag is less than one second for a pressure drop of above 200 psi. (auth)

16456 WAPD-AD-TH-519

Westinghouse Electric Corp. Bettis Atomic Power Div., Pittsburgh.

DEPARTURE FROM NUCLEATE BOILING TESTS AT 2000 PSIA ON RECTANGULAR CHANNELS WITH A FLUX PEAK IN THE CORNERS. R. A. DeBortoli. [June 1959]. 47p. $7.80(ph), $3.30(mf) OTS.

A study was made to determine the effect of extending nuclear fuel to the edge of the coolant channel on departure from nucleate boiling conditions (DNB). DNB conditions were determined with vertical upflow of water at 2000 psia for electrically heated specimens such as type 304 stainless steel and Zircaloy-2. These specimens were designed to simulate the extension of the fuel to the full width of a rectangular coolant channel. Test sections are described followed by discussion of results and conclusions. Also included are data and diagrams. (J.R.D.)

16457

RE-ENTRY HEAT TRANSFER. Lester Lees (California Inst. of Tech., Pasadena). Astronautics 4, No. 3, 22-3; 60; 62; 65(1959) Mar.

Re-entry heat transfer problems are discussed. Analysis of heat-transfer dynamics shows how ablating shields for re-entry vehicles provide heat protection and freer guidance and control. (A.C.)

Nuclear Properties and Reactions

16458 AD-208137

Ohio State Univ., Columbus.

GAMMA RAYS OBSERVED IN RUTHENIUM 101 (thesis). Henry Wisner Parlett. 1958. 109p.

The half life of the short-lived isomer of Rh^{101} was determined to be 4.52 ± 0.5 days, and the energy levels of its daughter Ru^{101} were determined to be 0.129, 0.307, 0.320, 0.545, 0.721, and 1.746 Mev. Other levels are possible but could not be definitely established. (auth)

16459 AECU-4181

Michigan. Univ., Ann Arbor. Harrison M. Randall Lab. of Physics.

ANGULAR CORRELATION OF GAMMA RAYS IN Sc^{47}. R. E. Sund, R. G. Arns, and M. L. Wiedenbeck. Jan. 26, 1959. 6p. $1.80(ph), $1.80(mf) OTS.

Gamma rays in Sc^{47} following beta decay of Ca^{47} were studied with angular correlation techniques. These measurements and the results of previous research favor spin and parity assignments of $5/2-$, $3/2-$, and $7/2-$ for the 1.31 Mev, 0.480 Mev (or 0.830 Mev), and ground state levels, respectively. The multipolarities of gamma transitions are given. (auth)

16460 AECU-4185

Purdue Research Foundation, Lafayette, Ind.

RESEARCH IN NUCLEAR PHYSICS. Progress Report No. 9, June 15, 1959. 91p. Contract AT(11-1)-122. $13.80(ph), $4.80(mf) OTS.

Studies of alpha scattering at 19 Mev were extended to include N^{14}. Data are also reported on the angular dependence of protons in $F^{19}(\alpha,p)$ and the energy dependence of $C^{12}(\alpha,p)$. Angular correlation studies were continued with beta-gamma directional correlation and circular polarization measurements. Results are included from investigations of conversion electron polarization following beta decay. Preliminary measurements of positron spectra from Na^{22} and Zn^{65} were made using scintillation techniques. Preliminary results are also reported from studies of Cd^{115m} beta decay, Ag^{106} decay (γ,np) and $(\gamma,3n3p)$ reactions in Ca^{40}, and isomeric states in In^{112}. Instrument designs and schemes used in the various investigations are included. (For preceding period see AECU-3696.) (D.E.B.)

16461 LA-2177

Los Alamos Scientific Lab., N. Mex.

NEUTRON SCATTERING BY U^{235}, Pu^{239}, and U^{238}. Lawrence Cranberg. Jan. 1959. Includes Appendix II by Jules S. Levin. 51p. Contract W-7405-eng-36. $1.50(OTS).

Data are presented on the angular distribution of elastic scattering and on the spectrum of inelastically scattered neutrons for incident neutrons of energies

0.55, 1, and 2 Mev for scatterers of U^{235} and Pu^{239}, using a pulsed-beam time-of-flight method. New information on elastic scattering for U^{238} at 0.98 Mev is also included. Inelastic cross sections are lower than those reported by others. Unexpectedly large differences in total and in differential elastic scattering cross sections are noted among these elements at the two lower energies. A simple, new procedure is given for calculating the correction to the total elastic scattering cross section due to neutron attenuation and multiple scattering. (auth)

16462 NP-7694
Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas.
ON THE ANALYTIC PROPERTIES OF PARTIAL AMPLITUDES. S. W. MacDowell. 1959. 19p. (Notas de Física Vol. V, No. 3).

The analytic properties of partial wave amplitudes in meson-nucleon scattering are investigated on the basis of the Mandelstam's representation, and an integral representation is set up for them which explicitly exhibits those properties. (auth)

16463 NYO-6141
Columbia Univ., New York.
REACTIONS OF 378 MEV PROTONS WITH ARSENIC (thesis). J[ames] B. Cumming. June 11, 1954. 101p. Contract AT(30-1)-1019. \$16.80(ph), \$5.70(mf) OTS. (CU-17-54-AEC-1019-Chem).

Targets of arsenic metal or arsenic compounds were bombarded with 378-Mev protons in the circulating beam of the Nevis cyclotron. Following chemical separation of the products into elemental fractions from potassium to selenium, the relative yields of more than 60 radioisotopes were determined by absolute beta and x-ray proportional counting. The absolute cross sections for forming several of these products were measured by comparison of their formation rates with the formation rate of Na^{24} from Al in a target containing a known ratio of arsenic to aluminum atoms. The total inelastic cross section of arsenic (including interpolated values) is estimated to be 870 ± 180 mb. (auth)

16464 OOR-2140.1
Florida State Univ., Tallahassee.
AN EXPERIMENTAL STUDY OF NUCLEAR MODELS. II. NUCLEAR LEVELS DETERMINED BY INELASTIC SCATTERING. Interim Technical Report No. 1. Raymond K. Sheline. May 1, 1959. 16p. Contract DA-01-009-ORD-705. (AD-215775).

A Sm^{152} target made by electromagnetic isotope separation was bombarded with 7.5 to 8.5 Mev deuterons and 8.6 Mev protons. Inelastic scattered groups corresponding to Coulomb excitation of the level at 122 kev were observed in every case, and in one run with 8.5 Mev deuterons Coulomb excitation of levels at 807 kev and 1079 kev was seen. The reduced transition probabilities for the two highest excited states are several times the single particle values, indicating the collective nature of both of these states. These levels are interpreted as beta- and gamma-vibrational states. The partial lifetime and the nuclear strength parameter for the EO-transition between the 807 kev and the 122 kev levels were calculated and found to be in agreement with the theoretical values. (auth)

16465 USNRDL-TR-322
Naval Radiological Defense Lab., San Francisco.
Fe^{59} DECAY SCHEME. J. M. Ferguson. May 25, 1959. 20p.

The gamma-ray spectrum of 45-day Fe^{59} was investigated with scintillation detectors. In addition to the previously reported gamma rays at 0.19, 1.10, and 1.29 Mev, gamma rays at 0.14 and 0.33 Mev were observed. The positions of these gamma rays in the decay scheme are established from the gamma-ray energies and coincidence measurements. It is concluded that a level in Co^{59} at 1.43 Mev with a character of ½- is weakly excited by the Fe^{59} beta decay. (auth)

16466 AEC-tr-3712
STUDY OF URANIUM FISSION WITH AN AUTOMATIC WILSON CLOUD CHAMBER. SECTION 4. PROBABILITY OF TRIPLE FISSION WITH A THIRD FRAGMENT OF SHORT PATH LENGTH. H. de Laboulaye (Laboulage), C. Tzara, and T. Olkowsky. Translated from J. phys. radium 15, 477-82(1954). 14p. \$3.30 (ph), \$2.40(mf) JCL.

Tripartition, in which a light fragment with a short path length is emitted, is studied using an automatic Wilson cloud chamber. The method permits a localization of the point of fission and establishes the third particle as a fission product. A result of 1 ± 3 tripartitions/1000 fissions was obtained. (W.D.M.)

16467
ELECTRONS EMITTED IN MESON (μ) CAPTURE AND THE IMPORTANCE OF FERMI INTERACTIONS. Bernard Jouvet and Jean-Claude Houard. Compt. rend. 248, 2375-7(1959) June 8. (In French)

The value of the ratio $\lambda^2 = \mu \to e/\mu \to \nu < 5 \times 10^{-4}$ in meson (μ) capture leads to the prediction either that the radius of nucleonic Fermi interactions is greater than 0.4×10^{-14} cm or that a heavy boson of baryon number 1 exists. In the latter case the nucleon-neutrino interaction has a cross section $(1/\lambda)^2$ times as great as that of neutrino capture. (T.R.H.)

16468
SCATTERING OF FAST NUCLEONS BY THE C^{12} NUCLEUS ACCORDING TO THE α MODEL SCHEME. Jean-Loup Picou. Compt. rend. 248, 3272-4(1959) June 8. (In French)

In the α model scheme with certain approximations, the cross section, polarization, and assymetry of C^{12} proton scattering can be related in a simple manner to these same parameters for He^4 proton scattering. These results are compared to those given by the independent particle model. (tr-auth)

16469
DISINTEGRATION OF Ag^{110m}. H. W. Taylor and S. A. Scott (Queen's Univ., Kingston, Can.). Phys. Rev. 114, 121-6(1959) Apr. 1.

The gamma radiations of Ag^{110m} have been studied using a conventional scintillation coincidence spectrometer and the gamma-ray summing technique. The positions of the 1484-, 735-, and 1560-kev gamma rays in the decay scheme have been determined. (auth)

16470
GAMMA-GAMMA DIRECTIONAL CORRELATION IN Cd^{110}. H. W. Taylor and W. R. Frisken (Queen's Univ., Kingston, Can.). Phys. Rev. 114, 127-32(1959) Apr. 1.

Directional correlation experiments have been performed for the 1385-885, 760-1510, and 940-885 kev gamma-ray cascades in Cd^{110}. Spins of 5, 6, 3, 4 have been assigned to the levels at 2935, 2490, 2170, and 1540 kev in the Cd^{110} level scheme. The 1385- and 1510-kev gamma rays are dipole-quadrupole mixtures. (auth)

16471
LIGHT-PARTICLE SPECTRA FROM THE NITROGEN

BOMBARDMENT OF OXYGEN. M. L. Halbert and A. Zucker (Oak Ridge National Lab., Tenn.). Phys. Rev. 114, 132-36(1959) Apr. 1.

Energy spectra and angular distributions were measured for protons and α particles resulting from the nitrogen bombardment of oxygen. It was found that the angular distributions of protons are reasonably isotropic whereas α particles are peaked in the forward direction. The energy distributions at various angles were compared with the predictions of a simple level density formula $w = C \exp[2(aE^*)^{1/2}]$. The constant a was found to be $a = 2.5 \pm 0.2$ from proton spectra, $a = 1.3 \pm 0.2$ from α-particle spectra at all angles measured. The energy spectrum of deuterons was measured at 15 deg and a value of $a = 1.8 \pm 0.3$ was found. Unexplained structure was observed in the spectrum of α particles emitted at zero degrees. After correction for the phase space available and the barrier penetration, it was found that α particles are emitted on the order of ten times more copiously than protons, while deuterons are about half as abundant as protons. (auth)

16472

LOW-INTENSITY CONVERSION LINES FROM Sm^{151} AND Sn^{113}. W. T. Achor (Vanderbilt Univ., Nashville and Western Reserve Univ., Cleveland) and W. E. Phillips, J. I. Hopkins, and S. K. Haynes (Vanderbilt Univ., Nashville). Phys. Rev. 114, 137-42(1959) Apr. 1.

The electron spectrum of Sm^{151} has been measured with a lens spectrometer and its gamma-ray spectrum with a scintillation spectrometer. The L-conversion coefficient of the 21.7 ± 0.3 kev de-excitation of the first excited state of Eu^{151} is 20 ± 4, with $(\alpha_L/\alpha_{M+N}) = 2.2 \pm 0.4$ and $\alpha_M/\alpha_N = 2.2 \pm 0.2$ indicating M1 multipolarity. The low intensity of the conversion electrons relative to the continuous beta spectrum of end point 75.9 ± 0.6 kev implies the existence of a weak beta transition whose end point is 54.2 ± 0.7 kev. The beta branching ratio, 54.2-kev beta transitions/75.9-kev beta transitions, is 1.7/100. $\log_{10}ft$ values for the two beta decays are 7.6 ± 0.2 for the 75.9-kev decay and 8.8 ± 0.2 for the 54.2-kev decay. A partial analysis of the decay in terms of the Nilsson-Gottfried scheme has been made, but no definitive assignment for the 21.7-kev state appears to be possible. Measurements of the electron spectrum of Sn^{113} with the lens spectrometer reveal the existence of a weak conversion line corresponding to a transition of 253 kev. The intensity of this conversion line is $(2.8 \pm 1.0) \times 10^{-3}$ of the intensity of the conversion line from the 392-kev transition. This relative conversion electron intensity indicates that the 253-kev transition leads to the 392-kev state of In^{113}, implying the existence of an excited state at 645 kev. The existing uncertainty in the relative gamma-ray intensities for the two transitions makes it impossible to assign spin and parity to the 645-kev state; the decay scheme presented is therefore incomplete. (auth)

16473

GAMMA-RAY EXCITATION OF THE 15.1-MEV LEVEL IN C^{12}. E. L. Garwin (Univ. of Chicago). Phys. Rev. 114, 143-54(1959) Apr. 1.

The parameters of the 15.1-Mev level in C^{12} have been determined. The angular distribution of scattered photons has been determined to be dipole. A scatterer-associated background to the scattering from this level has been demonstrated. The peak absorption cross section of 29.7 ± 1.1 barns has been determined from a self-absorption experiment. The self-absorption measurement and a production experiment combine to give values of 64.5 ± 10.4 ev and 59.2 ± 9.7 ev for the total level width and radiative width to the ground state, respectively. The combination of the value of the integrated elastic scattering cross section from the absolute measurement, and those values calculated from the self-absorption and production experiments gives for this integrated cross section the value 2.33 ± 0.19 mb-Mev. The radiation width to the 4.43-Mev state of C^{12} is determined to be 3.2 ± 2.5 ev by fitting the detector resolution function to observed pulse-height spectra. A value for the inelastic scattering in the giant resonance region of C^{12} is determined. (auth)

16474

EXCITATION FUNCTIONS OF U^{235} AND U^{238} BOMBARDED WITH HELIUM AND DEUTERIUM IONS. J. Wing, W. J. Ramler, A. L. Harkness, and J. R. Huizenga (Argonne National Lab., Lemont, Ill.). Phys. Rev. 114, 163-73(1959) Apr. 1.

Cross sections were determined for the reactions $U^{238}(He^4,n)Pu^{241}$ [including $U^{238}(He^4,p)Np^{241} \xrightarrow{\beta^-} Pu^{241}$], $U^{238}(He^4,2n)Pu^{240}$, $U^{238}(He^4,3n)Pu^{239}$, $U^{238}(He^4,4n)Pu^{238}$, $U^{238}(He^4$, fission), $U^{235}(He^4,n)Pu^{238}$, and $U^{235}(He^4,3n)Pu^{236}$ induced by helium ions of energies from 18.0 to 43.0 Mev. The yields of Pu^{239}, Pu^{240}, and Pu^{241} were determined by a mass spectrometric technique. Cross sections were measured for the reactions $U^{238}(d,p)U^{239}$, $U^{238}(d,2n)Np^{238}$, $U^{238}(d,4n)Np^{236}$(22 hr), U^{238}(d,t; d,p2n) U^{237}, $U^{235}(d,n)Np^{236}$(22 hr), $U^{235}(d,2n)Np^{235}$, and $U^{235}(d,3n)Np^{234}$ induced by deuterons of energies from 5.8 to 21.5 Mev. The above excitation functions are compared with similar excitation functions of nonfissile nuclei to show the effect of fissionability on spallation cross sections. Mean values of Γ_n/Γ_f are derived for several heavy nuclides by fitting the experimental excitation functions with theoretical cross sections calculated from the Jackson model modified for fission. In addition to the discussion on the compound-nucleus formation mechanism, some discussion of the experimental evidence for direct interactions is given. (auth)

16475

POLARIZATION OF NEUTRONS FROM $Li^7(p,n)Be^7$ AND FROM n-d SCATTERING. L. Cranberg (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 114, 174-5(1959) Apr. 1.

The polarization of neutrons produced in the reaction $Li^7(p,n)Be^7$ has been examined by using n-He^4 scattering as an analyzer and the pulsed-beam time-of-flight technique as a neutron spectrometer. Results are reported up to 4.95-Mev proton energy. The data include results on the neutron groups corresponding to beryllium-7 being left in its ground state and first excited state. Using neutrons of 2.1 Mev which are polarized 38%, the polarization for n-d scattering at several angles has been found to be less than 0.07, which is consistent with a prediction by Christian and Gammel of negligible polarization. (auth)

16476

T(p,p)T SCATTERING NEAR THE $T(p,n)He^3$ THRESHOLD. Nelson Jarmie and Robert C. Allen (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 114, 176-8(1959) Apr. 1.

The absolute cross section of T(p,p)T elastic scattering at center-of-mass angles of 58° 38′ and 109° 31′ has been measured as a function of energy near the $T(p,n)He^3$ threshold. Small but distinct perturbations are observed near the threshold and are discussed in the light of theoretical predictions. The bearing of the data on a possible excited state in He^4 at 20 Mev is discussed. (auth)

16477

DISTRIBUTION OF THE ANGULAR MOMENTA, LEVEL SPACINGS, AND NEUTRON WIDTHS OF Al^{28}. Carl T. Hibdon (Argonne National Lab., Lemont, Ill.). Phys. Rev. 114, 179-94(1959) Apr. 1.

The neutron total cross section from about 1 kev to 450 kev shows the presence of sixty-six peaks, seven of which are of the s-wave variety. Thirteen resonances are attributable to J = 0, twenty-one to J = 1, eighteen to J = 2, ten to J = 3, and three to J= 4. This distribution is in agreement with the theoretical distribution for a value of $2c\tau \equiv 2\sigma^2 = 6$. The density of all levels for this energy interval is 146 Mev^{-1} and the average level spacing of the nucleons is 0.48 Mev. The neutron widths vary from 1 to 7 kev and the distribution of the reduced widths appears to agree with an exponential distribution and is also in fair agreement with the Porter-Thomas distribution. The level spacings also agree with an exponential distribution. As obtained from the reduced widths averaged over both values of J, the value of the strength function for $l = 0$ is 0.05, averaged over all values of J for $l = 1$ it is 0.49, and for $l = 2$ it is too large in comparison with the p-wave strength function. The particularly low value of the cross section below 30 kev and the shape of the wings of the 35-kev resonance can be explained by a multiple-level computation of the interference of the s-wave levels. On the basis of the results of the present analyses, the levels are about equally divided between the odd and even values of l. (auth)

16478

DIFFERENTIAL ELASTIC SCATTERING OF NEUTRONS FROM NEON. H. O. Cohn and J. L. Fowler (Oak Ridge National Lab., Tenn.). Phys. Rev. 114, 194-200(1959) Apr. 1.

Neutron elastic scattering from neon of natural abundance has been investigated in the energy range 0.8 to 1.9 Mev. The total cross section was measured by the standard method of attenuating a neutron beam by a sample, which in this case was neon gas contained in a meter-long steel cylinder at high pressure. Differential cross sections were observed both by measuring neon recoil energies in a proportional counter and also by detecting neutrons with an anthracene crystal in coincidence with neon recoils. The combination of techniques shows up resonances at the following energies (in Mev) with spin and parity assignments given in parentheses: 0.91 ($\frac{3}{2}$−); 1.28 ($\frac{3}{2}$−); 1.31 ($\frac{1}{2}$−); 1.37 ($\frac{3}{2}$ or $\frac{5}{2}$+); 1.62 ($\frac{3}{2}$−); 1.68 ($\frac{3}{2}$+); and 1.85 (···). These resonances have reduced widths of the order of one percent of the Wigner limits. (auth)

16479

STUDY OF THE NEUTRON REACTIONS $Li^6(n,\alpha)H^3$, $F^{19}(n,\gamma)F^{20}$, AND $I^{127}(n,\gamma)I^{128}$. Fletcher Gabbard, Robert H. Davis, and T. W. Bonner (Rice Inst., Houston, Tex.). Phys. Rev. 114, 201-8(1959) Apr. 1.

The reactions $Li^6(n,\alpha)H^3$, $F^{19}(n,\gamma)F^{20}$, and $I^{127}(n,\gamma)I^{128}$ were studied using scintillating crystals both as targets and as detectors. The neutrons were produced by the $Li^7(p,n)Be^7$ and $T^3(p,n)He^3$ reactions. A redetermination of the $Li^7(p,n)Be^7$ differential cross section was made in the proton energy range 1.9 to 3.0 Mev at 0° and the cross section observed at 2.27 Mev was 154 mb. Cross sections for this reaction were determined at 120° for proton energies below 2.4 Mev and at 60° for energies below 2.1 Mev. The $Li^6(n,\alpha)H^3$ reaction cross section was studied for neutron energies between 0.025 and 4 Mev. The resonance at 0.255 Mev was observed to have a width (lab) of 0.125 Mev and a maximum cross section of 2.80 barns. A fit of the dispersion theory to this resonance yielded the following parameters in the center-of-mass coordinates: $\gamma_n^2 = 0.41$ Mev-cm, $\gamma_\alpha^2 = 0.015$ Mev-cm, $\Delta_\lambda = 0.17$ Mev, $E_\lambda = 0.039$ Mev, and $\Gamma = 0.188$ Mev at the resonant energy. Sixteen resonances were observed in the $F^{19}(n,\gamma)F^{20}$ reaction at neutron energies of 0.027, 0.048, 0.100, 0.177, 0.270, 0.308, 0.388, 0.425, 0.500, 0.600, 0.760, 0.865, 0.950, 1.125, 1.290, and 1.635 Mev. The radiative widths Γ_λ of twelve of these resonances vary between 1.1 and 8.6 ev. A monotonically decreasing cross section was observed for the $I^{127}(n,\gamma)I^{128}$ reaction between 0.025 and 0.500 Mev. (auth)

16480

TOTAL CROSS SECTION FOR n-p SCATTERING AT 20 MEV. R. B. Day, R. L. Mills, J. E. Perry, Jr., and F. Scherb (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 114, 209-14(1959) Apr. 1.

The total scattering cross section for neutrons incident on protons has been measured in a good-geometry transmission experiment. The scatterer was hydrogen gas contained in a pressure vessel one meter long, at a pressure of 4000 psi. The resulting cross section is $\sigma_t = 0.494_2 \pm 0.025$ barn at a laboratory neutron energy of 19.665 ± 0.026 Mev. (auth)

16481

$C^{13}(p,\gamma)N^{14}$ 1.47- AND 2.11-MEV RESONANCES AND THE ODD-PARITY LEVELS OF MASS 14. E. K. Warburton (Brookhaven National Lab., Upton, N. Y. and Princeton Univ., N. J.) and H. J. Rose and E. N. Hatch (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 114, 214-40(1959) Apr. 1.

A study has been made of the γ rays emitted by the 8.9- and 9.5-Mev levels of N^{14} using the $C^{13}(p,\gamma)N^{14}$ reaction at the 1.47- and 2.11-Mev resonances. The decay schemes of these levels were reinvestigated using a three-crystal pair spectrometer, NaI(Tl) single-crystal measurements, and standard $\gamma-\gamma$ coincidence techniques. The anisotropies relative to the bombarding beam of most of the observed γ transitions were measured using the three-crystal pair spectrometer. The angular distributions of some of the γ transitions were measured using a single NaI(Tl) crystal. Measurements were made of the Doppler shifts of the ground state decay of the N^{14} 5.10-Mev level and the cascade from the N^{14} 5.83-Mev level to the N^{14} 5.10-Mev level. From these Doppler shift measurements the mean lifetime of the N^{14} 5.83-Mev level was found to be in the range $(5\text{-}65) \times 10^{-14}$ sec; while an upper limit of 3×10^{-13} sec was set on the mean life of the N^{14} 5.10-Mev level. The results of the study of the γ decay of the N^{14} 9.5- and 8.9-Mev levels combined with the results of earlier measurements give conclusive assignments of 2^-, 3^-, 3, and 2 for the N^{14} levels at 9.50, 8.90, 5.83, and 5.10 Mev. The 5.83-Mev level most probably has odd parity. A tentative assignment of J = 2 is given to the N^{14} 7.02-Mev level. Evidence is presented, from this and previous investigations, that indicates the N^{14} 8.06-, 8.70-, 8.90-, and 9.50-Mev levels arise from the s^4p^92s and s^4p^9d configurations with the largest contribution being from the $(p_{\frac{1}{2}}2s_{\frac{1}{2}})$ configuration for the 8.06- and 8.70-Mev levels and from the $(p_{\frac{1}{2}}d_{\frac{5}{2}})$ configuration for the 8.90- and 9.50-Mev levels. The analogs of these T = 1 levels in C^{14} are almost certainly the C^{14} 6.09-, 6.89-, 6.72-, and 7.35-Mev levels, respectively. The T = 0, s^4p^92s and s^4p^9d states of N^{14} are also discussed. It is proposed that the 4.91-, 5.69-, 5.10-, and 5.83-Mev levels of N^{14} are 0^- and 1^-, $s^4p^92s_{1/2}$ and 2^- and 3^-, $s^4p^9d_{5/2}$ states, respectively. (auth)

16482

LIFETIMES OF THE FIRST EXCITED 0+ STATES OF Ca^{40} AND Zr^{90}. Robert M. Kloepper, Robert B. Day, and David A. Lind (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 114, 240-9(1959) Apr. 1.

The first excited states of Ca^{40} and Zr^{90} are 0+ states which decay to the 0+ ground state primarily by the emission of internal pairs or conversion electrons. These states have been excited by neutron inelastic scattering and their decay times have been observed by detecting the 0.51-Mev annihilation gamma rays as a function of time. The experimental method utilized a pulsed neutron source and the standard ring geometry often used for inelastic scattering measurements. Proton excitation of Ca^{40} in a different geometry was also used. To measure the lifetimes, the pulse-height spectra from a NaI(Tl) scintillation counter were recorded as a function of the delay time after the exciting pulse, and the intensity of the annihilation radiation was obtained from the area under the photopeak at 0.51 Mev. Selection of the time delays was made with the aid of either a time-to-pulse-height converter or a fast coincidence circuit. Mean lives for the first excited states of Ca^{40} and Zr^{90} were found to be $(3.4 \pm 0.2) \times 10^{-9}$ sec and $(90 \pm 6) \times 10^{-9}$ sec, respectively. Corresponding values of the reduced matrix elements ρ are 0.15 and 0.056. (auth)

16483

NUCLEAR ENERGY LEVELS AND MASS OF NITROGEN-17. C. S. Littlejohn (Univ. of Chicago). Phys. Rev. 114, 250-5(1959) Apr. 1.

Energy levels and the atomic mass defect of the nucleus N^{17} have been determined by measuring the kinetic energies of proton groups produced in the reaction $B^{11}(Li^7,p)N^{17}$ on bombardment of isotopically separated B^{11} targets with 2-Mev Li^7 ions. The protons were counted at 90°, in the laboratory system, from the forward direction of the lithium beam. The group of highest energy gave an (M—A) value of 12.92 ± 0.06 Mev for the N^{17} ground state, corresponding to a physical atomic weight of 17.01388 ± 0.00006. Two completely resolved groups of lower energy showed excited states at 1.32 and 1.89 Mev. Two strong but incompletely separated peaks showed levels at 2.50 and 2.82 Mev of excitation. Incompletely resolved groups of lower energy indicated four higher states at 3.27, 3.57, 3.86, and 4.18 Mev. Due to low counting rates, intensity estimates are difficult but indicate that, at 90° and 2-Mev bombardment, the ground-state group is only ¼ as strong as the most intense groups which arise from the 2.50 and 2.82-Mev levels. The groups from the higher levels (3.3—4.2 Mev) are less intense by a factor of 0.7. A comparison is made of the spectrum of N^{17} with O^{17} and F^{17}. Coulomb corrections are applied to calculate the isotopic spin $T = 3/2$ sequence corresponding to the above levels in O^{17}, the lowest such level being predicted at 11.04 Mev in O^{17}. A brief discussion is given of the reaction and also of the interpretation in terms of nuclear shell structure of the levels observed. (auth)

16484

NUCLEAR PARAMETERS IN THE SCATTERING OF NUCLEONS BY CARBON. Richard Wilson (Harvard Univ., Cambridge, Mass.). Phys. Rev. 114, 260-7(1959) Apr. 1.

Scattering of protons and neutrons by carbon at small angles is discussed. It is shown that it is not possible to obtain a coherent understanding of the scattering at 310 Mev without including an increase of the radius due to nuclear forces. The increase required is in rough agreement with that calculated from nucleon-nucleon scattering. At 135 Mev, where more complete data are available, it is shown that this increase is not sufficient to obtain a coherent understanding. Either approximations break down, or there is a difference in the scattering of neutrons and protons in addition to the Coulomb forces. Further, small-angle polarization measurements are badly needed at both energies. (auth)

16485

0—600 kev GAMMA-RAY SPECTRA FROM THERMAL NEUTRON CAPTURE IN THE REGION A = 104 TO 198. James E. Draper (Yale Univ., New Haven). Phys. Rev. 114, 268-78(1959) Apr. 1.

The energies and absolute intensities of prominent peaks in the 0—600 kev region of the gamma-ray spectrum following thermal neutron capture have been measured with a single NaI(Tl) scintillation spectrometer. The elements investigated were rhodium, silver, cadmium, indium, antimony, tellurium, iodine, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, hafnium, tantalum, rhenium, iridium, platinum, and gold. (auth)

16486

DECAY PROPERTIES OF I^{136}. Noah R. Johnson and G. D. O'Kelley (Oak Ridge National Lab., Tenn.). Phys. Rev. 114, 279-85(1959) Apr. 1.

I^{136}, produced from the slow neutron fission of uranium, has been studied with scintillation techniques. From the single-crystal (NaI) and gamma-gamma coincidence spectra, gamma rays were found at energies of 0.20, 0.27, 0.39, 0.46, 0.53, 0.71, 1.00, 1.321 ± 0.006, 1.55, 1.72, 1.91, 2.25, 2.40, 2.63, 2.84, and 3.2 Mev. Also, from single-crystal (anthracene) and beta-gamma coincidence measurements, four beta-ray groups were observed with energies of 2.73, 4.23, 5.62, and 7.00 Mev, where the latter represents the I^{136}-Xe^{136} mass difference and is present in about 6% of the total beta-ray transitions. A partial decay scheme has been proposed, with energy levels in Xe^{136} at 1.32, 2.64, 2.84, 3.03, 3.23, 3.57, 3.74, and 4.20 Mev. The half-life of I^{136} was measured as 82.8 ± 1.5 seconds. In the course of this investigation a source of 3.8-minute Xe^{137} was prepared, and was found to emit prominent gamma rays of 0.26 and 0.45 Mev. (auth)

16487

RADIATIVE ALPHA-PARTICLE CAPTURE IN Ni^{58} AND Xe^{136} AT HIGHER ENERGIES. J. B. Ball, A. W. Fairhall, and I. Halpern (Univ. of Washington, Seattle). Phys. Rev. 114, 305-9(1959) Apr. 1.

The cross sections of the (α,γ) reaction have been measured as a function of bombarding energy in Ni^{58} and Xe^{136} up to about 35 Mev. In both cases the capture events were identified by means of the specific radioactivity produced in the reaction. In the bombardment of Ni^{58} it was necessary to make use of the tight angular spread of recoils in the capture reaction to distinguish these recoils from those of the $Ni^{60}(\alpha,2n)$ reaction. Both measured capture cross sections rise to a maximum value (Ni^{58} : 400 μb, Xe^{136} : 60 μb) at an excitation energy of about 20 Mev. A comparison of the observed cross sections with those obtained in (p,γ) reactions at similar energies suggests that these higher energy capture reactions take place largely through the formation of a compound nucleus rather than by any "direct" mechanism. (auth)

16488

ANGULAR DISTRIBUTIONS AND CORRELATIONS FOR ALPHA-PARTICLE SCATTERING BY C^{12}, Mg^{24}, AND Ca^{40}. G. B. Shook (Univ. of Washington, Seattle). Phys. Rev. 114, 310-21(1959) Apr. 1.

Angular distributions of alpha particles scattered from Mg^{24} and Ca^{40} are reported and effective interaction radii are obtained, based on the Born approximation for elastic scattering and direct-interaction theory for inelastic scattering. For Mg^{24}, levels at 0, 1.37, 4.2, and 6.3 Mev yield interaction radii of 6.4, 6.55, 6.5, and 6.5, respectively (units of 10^{-13} cm). Evidence is presented in support of the assignment of the 6.3-Mev level to Mg^{24} rather than to Mg^{25} or Mg^{26}, with spin and parity 1−. For Ca^{40}, levels at 0 and 4.48 Mev yield interaction radii of 6.65 and 7.3, respectively. Alpha-gamma angular correlations, which correspond closely to those predicted on the basis of direct-interaction theory, were obtained for C^{12} (4.43-Mev level) and for Mg^{24} (1.37-Mev level). For Ca^{40} (4.48-Mev level) the correlation corresponds qualitatively to that predicted for a 1− level with cascade decay through an intermediate state to ground level. Further evidence is presented which supports this interpretation. A higher level in Ca^{40} is observed at 8.4 Mev. All alpha bombardments were made at 43 Mev incident energy. (auth)

16489

CROSS SECTIONS FOR NUCLEAR REACTIONS INVOLVING NUCLEAR ISOMERS. Bruno Linder and Ralph A. James (Univ. of California, Los Angeles). Phys. Rev. 114, 322-5(1959) Apr. 1.

Cross sections for the reactions $Cr^{52}(p,n)Mn^{52m}$, $Cr^{52}(p,n)Mn^{52}$, $Ag^{107}(p,pn)Ag^{106m}$, $Ag^{107}(p,pn)Ag^{106}$, and $Cu^{63}(p,n)Zn^{63}$ were determined as a function of energy with the 20.6-Mev proton beam of the U.C.L.A. synchrocyclotron. The relative yields of Sr^{85}, Sr^{85m}, and Sr^{87m} obtained in the proton bombardment of rubidium were also determined. In all cases the isomer yield ratios varied with energy over the entire energy range studied. The results are discussed in terms of conservation of angular momentum, assuming compound nucleus formation. (auth)

16490

EFFECT OF CONFIGURATION MIXING ON MAGNETIC MULTIPOLE RADIATION. K. K. Gupta and R. D. Lawson (Univ. of Chicago). Phys. Rev. 114, 326-32(1959) Apr. 1.

Expressions for the matrix element governing the emission of magnetic multipole radiation are given. The effect of weak configuration mixing and the small additional contribution to proton matrix elements (~ 5%) arising from the nuclear spin-orbit interaction are considered. For M4 transitions, even in nuclei near closed shells, the theoretical matrix elements derived from pure configurations are too large by a factor of two. The effect of configuration mixing reduces these. Choosing a δ-function interaction of reasonable strength leads to a reduction of ~ 25% in the matrix element for $1g_{9/2} \rightarrow 2p_{1/2}$ transition in ${}_{39}Y_{50}{}^{89}$. The $(2p_{1/2})^{-1} \rightarrow (1g_{9/2})^{-1}$ transition in ${}_{38}Sr_{49}{}^{87}$ is reduced close to the required 50%. The $1h_{11/2} \rightarrow 2d_{3/2}$ matrix element becomes ~ 25% smaller. However, there are no data available for the nucleus ${}_{50}Sn_{65}{}^{115}$, with which one would like to make comparison. Finally, the $(1i_{13/2})^{-1} \rightarrow (2f_{5/2})^{-1}$ transition in ${}_{82}Pb_{125}{}^{207}$ has its matrix element reduced by only ~ 6%. Although the reduction in ${}_{39}Y_{50}{}^{89}$ is somewhat too small, one cannot make a positive statement that configuration mixing is incapable of explaining the experimental result since a two-body force of a more realistic type may close the gap between theory and experiment. However, for ${}_{82}Pb_{125}{}^{207}$ there seems no doubt that other effects, for example, meson currents, must be incorporated. (auth)

16491

EFFECTIVE MEAN FREE PATH OF ANTINUCLEONS IN NUCLEAR MATTER. Jose R. Fulco (Univ. of California, Berkeley). Phys. Rev. 114, 374-6(1959) Apr. 1.

The effective mean free path for antinucleons in nuclear matter is calculated at intermediate energies from the Fermi gas model, in terms of the nucleon-antinucleon total and differential scattering cross sections. The results are used to obtain the imaginary part of the optical-model potential in the formalism of Riesenfeld and Watson. (auth)

16492

NITROGEN INDUCED NUCLEAR REACTIONS IN SODIUM. Ryuzo Nakasima (Osaka City Univ.). Progr. Theoret. Phys. (Kyoto) 20, 625-30(1958) Nov.

The nuclear reactions $Na^{23}(N^{14};\alpha p)P^{32}$ and $Na^{23}(N^{14};\alpha 2p)Si^{31}$ are analyzed on the basis of the compound nucleus model. The ratio of the cross sections in both reactions at 26 Mev bombarding ion energy seems to be fairly well reproduced in terms of the usual compound nucleus picture, but the absolute values of these cross sections are anomalously small. Taking account of the effects of depressed Coulomb barrier height, the right order of magnitudes for the excitation cross sections of both reactions is obtained. According to the present investigation, it seems to be rather premature to argue definitely for the presence of buckshot type nuclear reaction, but suggestions and discussions concerning the reaction mechanism of the heavy ion induced nuclear reactions are given. (auth)

16493

THE INTERACTION BETWEEN TWO NORMAL HELIUM ATOMS. A CONSISTENT TREATMENT. Tasuke Hashino and Sigeru Huzinaga (Kyushu Univ., Fukuoka, Japan). Progr. Theoret. Phys. (Kyoto) 20, 631-42 (1958) Nov.

A consistent variation calculation of the interaction energy between two normal helium atoms from the repulsive region to the van der Waals region is reported. The LCAOMO method within single configuration approximation is used and two variation parameters are included in the wave function in such a way that the bonding and the anti-bonding orbitals can be deformed separately. The result of the calculation is satisfactory. (auth)

16494

THE FIRST FORBIDDEN β-DECAY. Tsuneyuki Kotani and Marc Ross (Indiana Univ., Bloomington). Progr. Theoret. Phys. (Kyoto) 20, 643-89(1958) Nov.

The energy spectrum, longitudinal polarization, and various β-γ correlations, with and without measurement of β or γ polarizations, are calculated for the first forbidden β decay. The theoretical expressions include finite nuclear size effects, in the form of a simple modification of older expressions. A short discussion of relevant Coulomb functions is presented. Interference from so-called third forbidden transitions is also included. The expressions are presented in a reasonably accurate expansion such that the energy dependence, dependence on real and imaginary parts of coupling constants, and dependence on independent nuclear matrix elements, are clearly revealed. Possibilities for testing the time reversal invariance of the interaction are discussed. The β-γ directional correlation is probably most useful for this purpose among the various possibilities in the first forbidden transiton. The transverse β polarization is probably not useful for this purpose (it may, however, be used to determine nuclear matrix elements). Determination of other general properties of the β-decay interaction from first forbidden decays is probably even more difficult. Special information that might, however, be obtained from examination of a 0-0 transition is discussed. It is proposed that there is a fruitful field for determining properties of specific nuclei by measurement of several properties of a single decay. Both accurate and simplified expressions are presented to show what may be looked for. Absolute measurement of γ polarization following β decay and measurement of the β-γ correlation and its energy dependence are very promising experiments; as are of course, (the widely known) accurate spectrum and longitudinal polarization measurements. A special discussion is presented of the RaE case, where it is pointed out that accurate longitudinal polarization measurements could be very helpful. (auth)

16495

AN ILLUSTRATIVE EXAMPLE OF THE NUCLEAR COLLECTIVE MOTION. Fumiaki Iwamoto (Rikkyo Univ., Tokyo). Progr. Theoret. Phys. (Kyoto) 20, 776-7(1958) Nov.

Elliott and others have shown that states of the rotational property emerge with a particular coupling among shell model configurations. A simple dynamical system with quadrupole interactions among particles is studied. This quadrupole interaction is the essential character of the model which exhibits the main features of nuclear collective motions. (A.C.)

16496

FOUNDATION OF DEFORMED POTENTIAL MODEL FOR NUCLEAR ROTATION. Kiyomi Ikeda, Minoru Kobayasi, Toshio Marumori, Sinobu Nagata, and Takanori Shiozaki (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 20, 960-70(1958) Dec.

Following the methods of Bohr and Mottelson, a formulation of the separation of the nuclear Hamiltonian into rotational and intrinsic parts is developed. In the light of this formulation, the foundation of various methods with the deformed potential model for the estimation of the moments of inertia for nuclear rotation is discussed and the interrelation among these methods is clarified. Treatments are restricted to the two dimensional case for simplicity. (auth)

16497

RADIAL DEPENDENCE OF IMAGINARY PART OF NUCLEAR OPTICAL POTENTIAL. Kichinosuke Harada (Atomic Energy Research Inst., Japan) and Nobuo Oda (Rikkyo Univ., Tokyo). Progr. Theoret. Phys. (Kyoto) 21, 260-8(1959) Feb.

The imaginary part of the nuclear optical potential for neutrons is calculated by volume direct processes on the basis of the statistical independent particle model with an effuse nuclear surface. It is shown that the localization of absorption near the surface, found by Bjorklund and Fernbach, can be reproduced using reasonable values for the relevant parameters. The effect of the Pauli exclusion principle, of the energy dependence of the two-body collision cross section, of the mass number dependence of the parameters, and of the correlation between nucleons are discussed. (auth)

16498

NUCLEAR MOMENTS OF INERTIA. Tatuoki Miyazima and Yasushi Wada (Tokyo Univ. of Education). Progr. Theoret. Phys. (Kyoto) 21, 269-98(1959) Feb.

The problem of nuclear moments of inertia is considered taking into account the effect of the internal motion phenomenologically. The kinetic energy of the internal motion is assumed to take the form of that of a symmetrical top. When the interactions between the irrotational and the internal motions are strong, the total system has a rotational energy spectrum whose moment of inertia is given by the sum of those of two motions. By means of the empirical data for the electric quadrupole excitations, their magnitudes are estimated. In consequence the internal motion is shown to be very important. Comparison with other methods is carefully examined, especially with the work by Hayakawa and Marumori. (auth)

16499

CALCULATION OF THE ACCUMULATIVE YIELDS IN THE FISSION OF URANIUM. Horacio E. Bosch and Sara M. Abecasis (Comisión Nacional de Energia Atómica, [Buenos Aires] and Universidad Nacional, Buenos Aires). Publs. com. nacl. energia atomica (Buenos Aires) Informe No. 4, 24p.(1959). (In Spanish)

A general method is given for the activity of a given nuclide obtained from uranium fission and the calculation of the accumulative yields of the nuclide. The numerical value is obtained by simple resolution of a system of equations. Some examples are given. (J.S.R.)

16500

TRANSITION PROBABILITIES AND NUCLEAR STRUCTURE IN Tl^{203}. Tor R. Gerholm and Horacio E. Bosch (Comisión Nacional de Energía Atómica, Buenos Aires). Publs. com. nacl. energia atomica (Buenos Aires) Informe No. 5, 23p.(1959). (In Spanish)

Although the shell model predictions are in good agreement with experimental data with respect to the energy level assignments for Tl nuclei, there is no complete accord with measured and theoretical transition probabilities. An analysis is made of these transition probabilities, and the coupling necessary to obtain agreement between experimental and theoretical values is determined for Tl^{203}. The results show that the electric quadrupole transitions were favored by a factor of 10 with respect to the theoretical predictions; the permitted magnetic dipole transition is inhibited by a factor of 5 and the forbidden $\underline{l}$ magnetic dipole transition is inhibited by a factor of 1000. By the introduction of a weak coupling between the independent particles and the nuclear core, the transition probabilities calculated for E2 transitions are 7.8 times higher than those obtained from calculations using the independent particle model. For transition probabilities for magnetic dipole transitions, the Arima, Horie, and Sano theory (Progr. Theoret. Phys. (Kyoto) 17, 567(1957)) is applicable for $\underline{l}$ forbidden transitions but not for permitted transitions. The internal conversion coefficient corresponding to the $\underline{d}\,3/2 \rightarrow \underline{s}\,1/2$ transition agrees with the experimental results. (J.S.R.)

16501

ON THE THEORY OF DIFFUSE REFLECTION AND

TRANSMISSION IN MULTIPLE ELASTIC SCATTERING. Adalbert Goertz (Allgemeinen Deutschen Philips-Industrie G.m.b.H., Laboratorium, Aachen). Z. Physik 155, 263-74(1959). (In German)

In order to determine the diffuse reflectivity and transmittivity of multiply scattered particles, there is not necessarily the need of solving the complete differentio-integral equation of multiple scattering. It can be shown that the problem reduces to solving a set of two simultaneous differential equations of the first order, provided that the amount of sideward scattering may be neglected. The solutions of these equations furnish all data required, if the mechanism of single scattering is known. (auth)

16502

EXACT SOLUTION FOR THE DIPOLE RADIATION OF HARMONIC OSCILLATORS. Walter C. Henneberger (Universität, Göttingen, Ger.). Z. Physik 155, 296-312 (1959). (In German)

As was shown by Bloch and by Bauer and Jensen, a "Schrödinger" wave packet, retaining its shape but performing a damped oscillation, may be found for an elastically bound electron when dipole radiation is taken into account. This result is rederived using the principal axis transformation of the Hamiltonian for the above mentioned problem as given by van Kampen. Moreover, the radiative decay of the first and higher excited states of the harmonic oscillator is treated in dipole approximation by the same method. One finds, besides the well-known results, that multiple quantum emission does not occur. No perturbation theory is used in any of the calculations. (auth)

16503

SINGLE SCATTERING OF MEDIUM-ENERGY ELECTRONS BY HEAVY NUCLEI. Joachim Kessler (Technischen Hochschule, Karlsruhe, Ger.). Z. Physik 155, 350-67(1959). (In German)

The Mott theory of the Coulomb-scattering of electrons and some experimental results do not agree. Therefore a new experimental method was used to investigate this problem: The 150-kev electrons were not scattered by foils but by gases of low pressure; to get enough scattering events in spite of the small number of scattering centers an annular counter was used, which integrated with respect to the azimuth angle. Scattering by a gaseous target had the important advantage that corrections for multiple scattering were negligible. The main experimental difficulty was the complete suppression of the electrons having been backscattered from the chamber walls. Relative cross sections were determined for 60, 90, 120, and 135 degrees for the atomic numbers 36, 54, and 80. The data are in agreement with the Mott theory within the experimental error of ±5%. (auth)

16504

SINGLE-PARTICLE MECHANISM IN PHOTONUCLEAR REACTIONS. G. M. Shklyarevskii (Inst. of Physics and Tech., Academy of Sciences, U.S.S.R.). Zhur. Ekspt'. i Teoret. Fiz. 36, 1192-6(1959) May. (In Russian)

The single-particle (direct) mechanism of photonuclear reactions at high energies is considered on basis of the shell model. It is shown that the momentum distribution of the ground nuclear state which this model yields permits one to explain the shift forward of the photoproton momentum distribution peak and to obtain the correct value for the cross section of the reaction. (auth)

16505

INVESTIGATION OF THE EXCITED STATES OF Re^{187}. M. V. Klimentovskaya and P. I. Shavrin (Moscow State Univ.). Zhur. Ekspt'. i Teoret. Fiz. 36, 1360-5(1959) May. (In Russian)

The excited state angular momenta and the multipolarities of the γ transitions of Re^{187} were obtained by measuring the angular correlation of the 552 to 134 kev, 480 to 134 kev and 72 to 134 kev γ cascades. The value $(2.2 \pm 0.5) \times 10^{-2}$ was obtained for the ratio of the E2 and M1 amplitudes of the radiation mixture, $\delta^2 = I(E2)/I(M1)$, corresponding to a γ transition of 134 kev energy. The relative intensity of the 552 kev γ line was determined. The internal conversion coefficient in the K shell was determined for the 134 kev γ transition. (auth)

16506

FORMATION OF ISOMERIC Mo^{93m} IN THE REACTION $Se^{80}(O^{16}, 3n)$. A. S. Karamyan, L. I. Rusinov, and V. A. Fomichev. Zhur. Ekspt'. i Teoret. Fiz. 36, 1374-6 (1959) May. (In Russian)

The Mo^{93m} isomer was obtained by irradiating the separated Se^{80} isotope with O^{16} ions accelerated in a 150 cm cyclotron. The isomer is formed as a result of evaporation of three neutrons from the nucleus produced as a result of complete coalescence of the Se^{80} and O^{16} nuclei. The excitation function of this reaction was determined and the absolute cross section for Mo^{93m} production was measured. (auth)

16507

ANGULAR DISTRIBUTIONS IN THE REACTIONS $Ne^{22}(d, p)Ne^{23}$ AND $Ar^{36}(d, p)Ar^{37}$. V. G. Sukharevskii (Moscow State Univ.). Zhur. Ekspt'. i Teoret. Fiz. 36, 1377-80(1959) May. (In Russian)

The angular distributions of protons emitted in stripping reactions (d, p) induced by 4 Mev deuterons in gas targets enriched with Ne^{22} and Ar^{36} were investigated. For the ground and first excited (0.98 Mev) states of Ne^{23} the orbital angular momenta of the captured neutrons l_n were found to equal 2 and 0 (shell model configurations $(1d_{5/2})^{-1}$ and $(2s_{1/2})^{-1}$; for the ground state of Ar^{37} l_n is equal to 2 $(1\,d_{3/2})^{-1}$ configuration). (auth)

16508

ACCOUNT OF NUCLEAR INTERACTION IN THE SCATTERING OF CHARGED PARTICLES ON NONSPHERICAL NUCLEI. A. D. Piliya. Zhur. Ekspt'. i Teoret. Fiz. 36, 1393-7(1959) May. (In Russian)

Nuclear interaction involved in the scattering on black nonspherical nuclei of charged particles possessing energies close to the height of the Coulomb barrier is considered. (auth)

16509

RESONANCE ABSORPTION OF ULTRASOUND ON NUCLEI. A. R. Kessel (Kazan State Univ.). Zhur. Ekspt'. i Teoret. Fiz. 36, 1451-6(1959) May. (In Russian)

A theory of resonance absorption of ultrasound on paramagnetic nuclei of the atoms of a simple cubic lattice is developed under the assumption that the spin-lattice interaction is determined by nuclear quadrupole forces. Absorption coefficients for spin transitions $\Delta m = 1$ and $\Delta m = 2$ were obtained for arbitrary directions of propagation and arbitrary polarizations of the sound waves. The theory for In^{115} in InSb is compared with the experiments. (auth)

16510

ANGULAR CORRELATIONS NEAR THE MULTIPLE PRODUCTION THRESHOLD. A. F. Grashin (Moscow Inst. of Engineering Physics). Zhur. Eksptl'. i Teoret. Fiz. 36, 1480-4(1959) May. (In Russian)

Limiting angular correlations near the threshold were obtained for reactions in which final products are an infinitely heavy nucleus and 2, 3, or 4 identical fermions with spin $\frac{1}{2}$. (auth)

16511

ON THE SHAPE OF EVEN-EVEN NUCLEI. A. S. Davydov and G. F. Filippov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1497-1502(1959) May. (In Russian)

A nuclear model which assumes a core and two nucleons in a shell of angular momentum j is considered. The energy as a function of the parameters β and γ is determined for various values of the total nucleon angular momentum. It is shown that in the ground state minimum of energy corresponds to a nonaxial shape of the nucleus providing $j > \frac{3}{2}$. (auth)

16512

ROTATIONAL STATES OF NON-AXIAL ODD NUCLEI. A. S. Davydov (Lebedev Inst. of Physics, Academy of Sciences, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1555-9(1959) May. (In Russian)

A theory is developed for the rotational states of odd nuclei whose ground state spin is due to the angular momentum $j = \frac{1}{2}$ of the outer nucleon. The energy of the rotational states is derived as a function of the parameter γ ($0 \leq \gamma \leq \pi/3$) which specifies the deviation of the nuclear shape from axial symmetry. (auth)

16513

ON THE AXIAL ASYMMETRY OF ATOMIC NUCLEI. D. A. Zaikin (Lebedev Inst. of Physics, Academy of Sciences, U.S.S.R.). Zhur Eksptl'. i Teoret. Fiz. 36, 1570-1(1959) May. (In Russian)

The numerical energy estimates for various nucleon configurations show that for several particles in the super locked shell, starting with three, the minimum energy can correspond to the non-axially equilibrated nuclear form. For instance, for the nuclear configuration $(1s)^2(1p)^6(1d)^4$, corresponding to Mg^{24}, the minimum energy is found at $\beta \approx 0.3$ and $\gamma \approx 7°$; $(1f)^2$ corresponding to Ti^{44}, $\beta \approx 0.2$ and $\gamma \approx 5°$. The obtained results are not considered precise; however, they show that the model of independent particles, in its simplest form, allows the possibility of nuclear, equilibrium deviation from axial symmetry. (R.V.J.)

16514

EFFECTS OF NUCLEAR STRUCTURE ON THE DEGREE OF ANGULAR ANISOTROPY IN FISSION PROCESSES. A. N. Protopopov and V. P. Eismont. Zhur. Eksptl'. i Teoret. Fiz. 36, 1573-4(1959) May. (In Russian)

A thermodynamic interpretation was attempted for the relation between the degree of angular distribution anisotropy $\sigma(0°)/\sigma(90°)$ and the fissioning nucleus parameter Z^2/A. The temperature of nuclei in a critical deformation state was determined for the 14.3 to 14.8 Mev neutron fission of Th^{232}, U^{238}, U^{235}, U^{233}, Np^{237}, Pu^{239}, and Am^{241}, and the dependence of $\ln \sigma(0°)/\sigma(90°)$ on 1/T was plotted. The fact that the data on the degree of the angular anisotropy form a straight line indicate that $\sigma(0°)/\sigma(90°)$ actually varies from one nucleus to another as $\exp(\Delta E/T)$ with $\Delta E = \text{const}$ and $T = f(Z^2/A)$. (R.V.J.)

16515

DIRECT INTERACTION IN REACTIONS WITH TWO-NUCLEON EMISSION. V. V. Komarov and A. M. Popova (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1574-6(1959) May. (In Russian)

The angular distributions from (n,2n), (p,2p), (n,n′p), (p,p′n) were studied. Calculations were carried out with the assumption that the wave function of the emitted nucleon (n_0) is in the shape of a flat wave; the wave function of the interacting nucleon (n_1) inside the nucleus (interacting with the incoming nucleon) was taken according to the shell model with the assumption of the LS bond. Numerical calculations were made of the angular distribution of the K_{2n} (pulse of two-nucleon center of gravity) vector in $Be^9(n,2n)Be^8$, considering that E_{no} = 14 Mev, the excitation energy of Be^8 is 2.9 Mev, and ϵ = 70 kev. The integration was carried out as the Be^8 kinetic energy changes from 0.5 to 2 Mev. The angular distribution curves of K_{2n} for $\rho = 1.0 \times 10^{-3}$ cm and $\rho = 2.8 \times 10^{-13}$ cm are shown. (R.V.J.)

16516

ON THE VARIATIONS IN β-DECAY INTERACTION. B. N. Valuev (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1578-80 (1959) May. (In Russian)

The effects of higher approximation for neutron β decay interaction were investigated, and it is shown that in some variations of the interaction the appearance of the matrix element does not vary as compared to the first approximation in the theory of perturbation. This holds true for all processes which can take place in the first approximation of H′, as for example $\overline{\nu} + \rho \rightarrow n + e^+$. This also holds when the interactions ($\overline{pn}$) ($\overline{\mu}\nu$), taken as it is expressed in H′, are considered in the described processes. (R.V.J.)

16517

ON THE NON-SPHERICAL NUCLEUS α DECAY CONSTANTS. V. G. Nosov (Inst. of Nuclear Power, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1580-1 (1959) May. (In Russian)

An analytical theory was developed previously for the α decay of nonspherical nuclei, and a set of simple formulas was derived for the relative intensities of fine structure lines. The expressions derived for the wave functions are used for calculating the absolute probability of the decay. The W_α for even-even nuclei of Cf, Cm, Pu, Ra, Th, and U was tabulated. The W_α constants for the whole range of α active nuclei confirm the basic postulations of the theory. The results showed for α decay $R_0 \geq 1.4A^{1/3} \times 10^{-13}$ cm. $\overline{W}_\alpha = 0.10$ for even nuclei while $\overline{W}_\alpha = 0.047$ for odd nuclei. (R.V.J.)

16518

THE M1 TRANSITION IN V^{51} NUCLEUS AND QUANTUM NUMBER "PRECEDENCE." N. N. Delyagin and M. Preisa (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1586-7(1959) May. (In Russian)

The life time of V^{51} at the 351-kev excitation level, measured by resonance scattering of γ quanta from Cr^{51} in $CrCl_2O_2$, was $\tau = 3.1 \pm 0.8 \times 10^{-10}$ sec. Considering the data on the Coulomb excitation of V^{51}, the result corresponds to a partial life time for the M1 component of the mixed M1 + E2 transition at 321 kev of 3.4×10^{-10} sec. The measured life time is about twice as high as the value obtained by H. Schopper (Zr. f. Phys. 144, 476 (1956)) by the method of resonance γ scattering, but it is close to the magnitude measured by retarded coincidences ($\tau = 4 \times 10^{-10}$ sec). A natural explanation for the obtained result is found in the forbiddance by the quantum number "the precedence." (R.V.J.)

16519

THE QUADRUPOLE MOMENT OF Er^{168}. E. E. Berlovich, V. G. Fleisher, V. I. Breslav, and B. K. Preobrazhenskii (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1589-90(1959) May. (In Russian)

The Er^{168} energy level at 80 kev, produced by K capture in Tm^{168}, was previously identified as the first level of the rotation band. Measurements of the level life time permit determination of the quadrupole moment and the parameter of Er^{168} deformation by generalization of nuclear model formulas. The internal quadrupole moment and deformation parameter calculated by Bohr formulas was $(7.6 \pm 0.6) \times 10^{24}$ cm² and 0.32 ± 0.03. The life time of the quadrupole moment is in good agreement with the value 7.8×10^{-24} cm² formerly derived from experiments on Coulomb excitation of Er^{168}. (R.V.J.)

16520

ON THE ANGULAR DISTRIBUTION OF NEUTRONS IN $C^{13}(\alpha,n)O^{16}$ REACTION. O. M. Mdivani and T. G. Gachechiladze (Tbilis State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1591-2(1959) May. (In Russian)

The angular distribution of neutrons in $C^{13}(\alpha,n)$ were measured for four α energies, $E_\alpha = 2.69$, 2.83, 4.42, and 4.63 Mev. The finite O^{16} nuclei are produced in their ground state. The character of the angular distribution changes slowly in relation to α energy. Moreover, the angular distributions have a sharply expressed forward and backward maximum. These factors lead to the assumption that the reaction occurs due to direct interaction with C^{12} in which the α particle penetrates the nucleus, knocks out the neutron, and is absorbed by the C^{12} field (forward pulses) or the neutron is liberated by the α particle analogous to a (d,n) reaction (backward pulse). The angular distribution calculations and experimental data are plotted, considering the spin of $C^{13} = \frac{1}{2}^-$, spin $O^{16} = 0^+$, spin $He^4 = 0^+$, and the odd neutron in C^{16} is in the S state. In both processes the absorption moment of the motion is equal to zero. (R.V.J.)

16521

THE ANGULAR DISTRIBUTION OF TRITONS FROM THE $Li^7(\alpha,t)Be^8$ REACTION. S. V. Starodubtsev and K. V. Makaryunas (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1594-5(1959) May. (In Russian)

The angular distribution of tritons from $Li^7(\alpha,t)$ ($Q = 2.56$ Mev) reactions with α energies of 8.34, 10.15, 11.5, 13.2, and 14.7 Mev was studied by a photographic emulsion method in order to determine the mechanism of the reaction. Similar angular distributions were obtained for all energies. The curves expressing the differential cross section dependence on the angle in the center of inertia system at $E_\alpha = 13.2$ and 14.7 Mev are plotted. The shape of the angular distributions and the weak dependence on bombarding energy indicate the important role of the direct interaction mechanism. The absolute differential cross sections at 16° (central inertia system) is equal to $9.2^{+3.7}_{-1.85}$ mb/sterad for $E_\alpha =$ 13.2 Mev and $9.4^{4.0}_{2.0}$ mb/sterad for $E_\alpha = 14.7$ Mev. (R.V.J.)

16522

THE MASS OF Pu^{239}. R. A. Demirkhanov, T. I. Gutkin, and V. V. Dorokhov. Zhur. Eksptl'. i Teoret. Fiz. 36, 1595-6(1959) May. (In Russian)

A mass spectrometer with 60,000 to 80,000 resolving power was used for measuring the mass of plutonium isotopes in doublet pairs prepared from Alizarin ($C_{14}H_8O_4$, $M = 240$) and another organic compound of perylene ($C_{20}H_{12}$, $M = 252$). The doublet ΔM mass differences and the corresponding isotope mass of Pu^{239} are tabulated. The results showed the mean isotope mass for Pu^{239} is equal to 239.128784 ± 165. (R.V.J.)

16523

ANGULAR ANISOTROPY AND ENERGY CHARACTERISTICS IN FISSION PROCESSES. A. N. Protopopov, I. A. Baranov, and V. P. Eismont. Zhur. Eksptl'. i Teoret. Fiz. 36, 1608-9(1959) May. (In Russian)

The energy characteristics of heavy nucleus anisotropy are analyzed for fission with and without preliminary neutron emission. The degree of anisotropy varies; hence the number of neutrons in the fissioned nuclei and the energy of excitation also vary in fissions at 0° to 90° to the incident particles. The energy of the fission fragments along the neutron beam (0°) and fission perpendicular to the beam (90°) from 14.9 Mev neutron fission of U^{238} were measured with a double-ionization chamber. Some 5000 fission events were recorded at 0° and 4000 at 90°. With the fragment mass ratio 1.40 to 1.44 the mean kinetic energy of fragments is 170.7 ± 0.6 Mev at 0° and 169.4 ± 0.8 Mev at 90°. (R.V.J.)

16524

RESONANCE SCATTERING BY Ni^{60} γ QUANTA. N. A. Burgov, Yu. V. Terekhov, and G. E. Bizina (Inst. of Theoretical and Experimental Physics, Academy of Sciences, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1612-13(1959) May. (In Russian)

The coincidences between γ quanta were recorded. The resolving time of the scheme of coincidences was 2×10^{-9} sec. The life time of the Ni^{60} first excited state was $\tau = (1.0 \pm 0.3) \times 10^{-12}$ sec (considering the molecular bonds). The results within the limits of error are in good agreement with previous data. (R.V.J.)

16525

CERTAIN γ TRANSITIONS IN I^{128} AND NEODYMIUM ISOTOPES. L. F. Kalinkin, A. S. Melioranskii, and I. V. Estulin (Moscow State Univ.). Zhur. Eksptl'. i Theoret. Fiz. 36, 1613-14(1959) May. (In Russian)

A single-crystal luminescence spectrometer with a NaI(Tl) crystal was used in studies of γ radiation produced by neutron capture in iodine and neodymium isotopes. The g lines with energies of 28 ± 2, 135 ± 3, and 158 ± 4 kev were found in the I^{128} spectrum at 20 to 400 kev. The intensities (in captured neutron %) were 23 ± 6, 20 ± 4, and 7.5 ± 1.5, respectively. The most probable multiplicity transitions were found to be E2 for 135 kev and M2 for 158 kev. The measurements on Nd were made with a Nd_2O_3 target. The energies of the γ lines were measured for mixed Nd isotopes and for Nd^{144}. The γ lines at 330 kev and part of the 445 and 610 kev lines belong to Sm^{150}. The γ lines 695 and 445 kev were related to Nd^{144} and Nd^{146} transitions from the initial state to the ground state. The existence of formerly unknown second excitation states at 1535 and 1055 kev, which emit the 840 and 640 kev γ quanta, is assumed. Moreover, the relations of the energies of these states to the initial levels of $E_2/E_1 = 2.2$ to 2.4 are inherent to to the oscillation levels of spherical even-even nuclei. (R.V.J.)

Theory

16526 NP-7593

Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas and Sao Paulo, Brazil. Instituto de Física Teorica.

EFFECT OF NON-LOCALITY IN FERMI INTERACTIONS DUE TO VECTOR MESONS ON THE DECAYS $\Sigma \rightarrow P + \gamma$ AND $\mu \rightarrow e + \nu + \bar{\nu}$. Prem Prakash and A. H. Zimerman. 1958. 12p. (Notas de Física Vol. IV, No. 23).

The effect of non-locality in Fermi interactions introduced by vector mesons on $\Sigma \rightarrow p + \gamma$ and $\mu \rightarrow e + \nu + \bar{\nu}$ are discussed. The branching ratio $\Sigma \rightarrow p + \gamma$ to $\Sigma \rightarrow p + \pi^0$ is calculated to be of the order of $\sim 10^{-4}$. It is shown, that in muon decay to get Michel's parameter $\leq {}^3/_4$, a vector meson mass greater than 10 proton masses is required. (W.D.M.)

16527

SOME CONSEQUENCES OF THE NON-LINEARITY OF THE EQUATION OF THE COMPLEX MESON FIELD. M. Zaganescu. Acad. rep. populare, Romîne, Baza cercetări ştiinţ. Timişoara, Studii cercetări ştiinţe chim. 5, 131-4(1958). (In Rumanian)

It is shown that if the non-linearity of the complex scalar meson field is considered, the equation $W^2/c^2 = p^2 + m_0^2c^2$ is replaced by the equation $W^3/c^2 = W(p^2 + m_0^2c^2) + n$, where n is a constant. In this manner, the energy of the meson shows its dependence on the spatial density of the mesons. (tr-auth)

16528

LONGITUDINAL POLARIZATION OF DIRAC PARTICLES AND PARITY NON-CONSERVATION. A. A. Sokolov. Izvest. Vysshikh Ucheb. Zavedenii Fiz. No. 5, 164-74(1958).

The vector equation of motion for a free Dirac particle is reviewed. A discussion on the longitudinal component of the vector equation, the component in the propagation direction, is presented. The properties of the longitudinal component for various Dirac particles are considered in some detail. (J.S.R.)

16529

THE INTEGRATION OF THE EQUATIONS OF MAGNETOHYDROSTATICS FOR CONFIGURATIONS WITH AXIAL SYMMETRY. E. Canobbio and R. Croci (Istituto Nazionale di Fisica Nucleare, Milan). Nuovo cimento (10) 12, 167-72(1959) Apr. 16. (In Italian)

A method to reduce the integration of the equation of magnetohydrostatics for a cylinder and a circular torus to that of a non-linear integro-differential equation is given. The equations obtained can be integrated numerically, and the stability of the solutions with respect to small variations in the conditions of the border can also be studied. (J.S.R.)

16530

THE INTEGRATION OF LINEARIZED EQUATIONS OF MAGNETOHYDROSTATICS. E. Canobbio and R. Croci (Istituto Nazionale di Fisica Nucleare, Milan). Nuovo cimento (10) 12, 173-6(1959) Apr. 16. (In Italian)

In the preceding paper (Nuovo cimento (10) 12, 167 (1959)) a method was given for the reduction of magnetohydrostatic equations for a cylinder or circular torus to a non-linear integro-differential equation. It is shown that by linearizing the equation obtained the system can be reduced to a linear differential equation. The integration of this equation and the comparison with the solutions of magnetohydrostatic systems is only possible numerically. (J.S.R.)

16531

SPECTRAL REPRESENTATIONS IN PERTURBATION THEORY. II. TWO-PARTICLE SCATTERING. Robert Karplus, Charles M. Sommerfield, and Eyvind H. Wichmann (Univ. of California, Berkeley). Phys. Rev. 114, 376-82(1959) Apr. 1.

In this paper a particular term in the perturbation expansion for the two-particle scattering amplitude is examined. We consider the real plane defined by the square of the total four-momentum and the square of the momentum transfer, and show that the scattering amplitude is an analytic function of both variables in a certain connected region in this plane. The precise boundary of the region is found. The purpose of this work is to find some conditions that integral representations of the scattering amplitude must satisfy, with the hope that such examples may aid the study of such integral representations in general. We also apply our general result to some particular cases of physical interest. (auth)

16532

ACCOUNT OF THE PHASE SHIFT UPON TRANSITION FROM "PARTICLES" TO "HOLES" IN THE NUCLEAR SHELL THEORY. V. V. Balashov (Moscow State Univ.). Zhur. Ekspti'. i Teoret. Fiz. 36, 1387-92(1959) May. (In Russian)

The second quantization method developed for calculation of the matrix elements of the F and G-operators in the nuclear shell theory is employed to establish the relation between the fractional parentage coefficients corresponding to the beginning and end of the shell. Variation of the phase shift upon transition from particles to holes is investigated. Selection rules with respect to the symplectic group are formulated for electromagnetic transitions in nuclei in the case of jj coupling. (auth)

16533

ON THE NUCLEAR OPTICAL MODEL. V. G. Grishin and M. I. Podgoretskii (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Zhur. Ekspti'. i Teoret. Fiz. 36, 1593-4(1959) May. (In Russian)

A mathematical analysis of fast particle scattering was carried out in Born approximation and in geometric optical approximation. (R.V.J.)

RADIATION EFFECTS ON MATERIALS

16534 AERE-C/R-2619

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

COMPARISON OF DATA ON THE OXIDATION OF GRAPHITE IN REACTORS. M. Tomlinson. Apr. 1959. 21p. $0.49(BIS).

Various reported values for the rate of oxidation of reactor-grade graphite when irradiated in air in a reactor at normal operating temperatures (60 to 200°C) show seemingly wide discrepancies, i.e., oxidation rates ranging from 0.024 to 4.5% graphite weight loss per 10^{20} neutrons/cm^2. It is shown how these apparent discrepancies can be reconciled in terms of the reaction scheme proposed. The apparent discrepancies arise because the oxidation rate is critically dependent upon the geometry of the system and the gas flow rate, in addition to the more obvious parameters. In the investigations considered, the gas flow rates covered a 2,000 fold range and this is the main reason for the difference in the observed oxidation rates. (auth)

16535 CF-58-1-36
Oak Ridge National Lab., Tenn.
SOME ASPECTS OF THE BEHAVIOR OF FISSION PRODUCTS IN MOLTEN FLUORIDE REACTOR FUELS. Mark T. Robinson, William A. Brooksbank, Jr., Samuel A. Reynolds, Henry W. Wright, and Thomas H. Handley. Jan. 17, 1958. 19p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

Observations are reported on the behavior of several fission product elements in molten $NaF-ZrF_4-UF_4$ fuels, irradiated in capsule experiments, forced-convection in-pile loop experiments, and in the Aircraft Reactor Experiment (ARE). The rare gases have been observed to escape readily from the fuels in dynamic tests, although in static tests the rate of escape is very low. Ruthenium and niobium deposit on the Inconel walls of the fuel container, probably as metals. Other fission products studied (Sr, Zr, La, Ce) appear to remain in the fuel. The results obtained are entirely consistent with theoretical predictions. It is suggested that the observed noble metal deposit may serve to reduce corrosion of metals by molten fluoride fuels. The unsatisfactory nature of Cs^{137} as a fission monitor in such fuels is reported, and the use of Zr^{95} as a substitute is discussed. (auth)

16536 CF-58-5-60
Oak Ridge National Lab., Tenn.
IRRADIATION STABILITY OF APPR-1 TYPE Fe-B CORED, STAINLESS STEEL CLAD CONTROL ROD SPECIMENS. A. E. Richt. May 14, 1958. 27p. Contract [W-7405-eng-26]. $4.80(ph), $2.70(mf) OTS.

In order to evaluate the irradiation stability of the APPR-1 type Fe−B cored, stainless steel clad control rod configuration, a test program consisting of the irradiation of both miniature absorber plates and an APPR-1 type full size control rod was initiated. The purpose of these irradiations was to determine the dimensional stability and structural integrity of this type of absorber material throughout a relatively wide range of B burnups. Results obtained from the post-irradiational examination are summarized. (W.L.H.)

16537 NP-7628
Stanford Research Inst., Menlo Park, Calif.
EFFECT OF RADIATION ON THE MECHANICAL PROPERTIES OF PLASTICS. Quarterly Progress Report for February 15, 1958 to May 15, 1958. Donald Morison Smith. May 23, 1958. 3p. SRI Project No. S-2296, Report No. 3. Contract DA-04-200-ORD-698.

Research aimed at relating radiation-induced chemical changes in plastics with changes in their physical properties by a correlation of dynamic modulus with other applicable variables is being conducted. Research effort during the report period was concentrated on developing and constructing an optical system to measure the amplitude of reed motion in the SRI version of the Strella dynamic modulus testing equipment. Polyethylene and polymethylmethacrylate reeds were prepared. It is noted that research was at a low level during the period pending completion of the optical system for the reed test. (J.R.D.)

16538 NP-7643
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
THE HOT ATOM CHEMISTRY OF ORGANIC PHOSPHORUS COMPOUNDS. PART 1. THE PRODUCTS OF NEUTRON IRRADIATION OF TRIBUTYL PHOSPHATE. Report No. 71/V. I. G. Campbell, A. Poczynajło, and A. Sidua. Mar. 1959. 26p.

A study was made of the chemical effects of neutron capture in tributyl phosphate. A procedure is given for fractionation of the inorganic P^{32} and preliminary fractionation of the P^{32} in organic combination. Retention of P^{32} in organic combination was studied as a function of neutron dose rate. Inorganic P^{32} is present predominantly as orthophosphate in final products, a small percentage of the total activity also being present as orthophosphite. (auth)

16539 WAPD-P-151
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
THE EFFECT OF GAMMA RADIATION ON THE DIELECTRIC BREAKDOWN STRENGTH OF POLYETHYLENE. W. L. Lawrence and S. Mayburg. Jan. 15, 1952. Decl. Oct. 14, 1958. 13p. Contract AT-11-1-GEN-14. $3.30(ph), $2.40(mf) OTS.

The dielectric breakdown strength of polyethylene was found to decrease during gamma irradiation. The results obtained during irradiation are in agreement with estimates made from data on the stopping of fast electrons in matter by the equation $F = -(1/e)(dE/dx)$, where F is the breakdown field, e the electronic charge and, $-dE/dx$ is the energy loss per cm for the Compton electron which initiates the breakdown avalanche. (auth)

16540 WCLF-TN-53-1
Wright Air Development Center. Photo Reconnaissance Lab., Wright-Patterson AFB, Ohio.
PRELIMINARY REPORT ON THE EFFECTS OF NUCLEAR RADIATION UPON PHOTOGRAPHIC FILM. James S. Moser. Jan. 1953. 10p. (AD-144586).

There is no definite information at present on the fog tolerance of film. The radiation tolerance of film to gamma rays seems to fall somewhere between 1 and 50 roentgens. Although the upper limit of 50 roentgens may be possible, it appears more likely that the range will fall between 1 and 10 roentgens. (W.L.H.)

16541
RADIATION EFFECTS ON INSULATION, WIRE, AND CABLE. C. J. Lyons and R. I. Leininger (Battelle Memorial Inst., Columbus, Ohio). Insulation 11p.(1959) May-June.

After a discussion of the mechanism of action of various radiations, data are given on the effects of radiations on specific plastics, elastomers, wire, and cable: natural rubber, styrene-butadiene rubber, acrylonitrile rubber, neoprene rubber, hypalon, polyacrylic rubber, silicone rubbers, butyl rubbers, fluorine rubbers, amino resins, cellulosics, epoxy resins, ethylene polymers, fluoroethylene polymers, isocyanate resins, phenolics, polyamides, polyesters, silicones, styrene polymers and copolymers, vinyl polymers and copolymers, and wire and cable with and without insulation, and electronic components. Methods for improving the radiation resistance of polymers and development of new radiation-resistant polymers is also discussed. (T.R.H.)

16542
THE EFFECT OF IONIZING RADIATIONS ON SOLID

INORGANIC DIELECTRICS (A REVIEW). V. K. Zhuravlev. Izvest. Vysshikh Ucheb. Zavedenii Fiz. No. 5, 79–83(1958).

A review is presented on the radiation effects on dielectrics. The alkali halide compounds, quartz, silicates, boron and lead phosphate glasses, ceramics, and mica were considered. The following conclusions were made. Various kinds of irradiation do not differ greatly in their effects on solids. The most important parameter is the total or integral dose given a sample. Temperature variations should not affect greatly the results obtained. Inorganic dielectrics are more strongly affected by ionizing radiations than metals, but less strongly than organic compounds. Irradiation stability depends on the energy of the crystal lattice, the electron mobility, and the packing density. Under some conditions amorphous dielectrics are more stable than crystalline materials. 34 references. (J.S.R.)

16543

THE EFFECT OF ELECTROMOTIVE FORCES PRODUCED BY X-RAY IRRADIATION OF DIELECTRICS ON RELATIONSHIPS WHICH GOVERN THE INDUCED CURRENT. F. I. Kolomoytsev and A. Ya. Yakunin. Izvest. Vysshikh Ucheb. Zavedenii Fiz. No. 5, 127–32 (1958).

The electromotive force induced in dielectrics by high-intensity x radiation was investigated. It was concluded that x rays and other high-energy photons produce an emf which may be of the order of hundreds or thousands of volts at high radiation intensities. The induced emf and the applied voltage from external sources are algebraically additive. The emf increases with x-ray intensity, following a power law, and it decreases exponentially with temperature. (J.S.R.)

16544

EXCITATION OF LUMINESCENT MATERIALS BY IONIZING RADIATION. H. Kallmann and J. Dresner (New York Univ.). Phys. Rev. 114, 71–9(1959) Apr. 1.

The buildup of light emission under irradiation by x rays and fast electrons was determined for several inorganic phosphors at room temperature and at −70°C. Measurements were performed under excitation by x-rays of 35 kev and 3.5 kev and by Sr^{90} β rays. From a knowledge of these rise curves of light emission, the effective volume of phosphor excited by a single ionizing event can be calculated. For the three types of irradiation used, it was found that the effective volumes of these channels of excitation are proportional to the amount of energy transferred to the phosphor by each ionizing particle and that the ratio between the initial and final values of the light emission is almost independent of the mode of excitation. This implies that the excited electrons diffuse out from the path of the ionizing particle until they are stopped by traps. Evaluation of this diffusion process indicates that only a small percentage of all available deep traps are filled within the effective channel volume by one single event and that a nonbimolecular process participates in the initial light emission. In the above cases, the electrostatic field produced by the positively charged core of the channels is too small to interfere with the diffusion of the excited electrons. In the case of irradiation by high-energy α particles, this field is large enough to inhibit the diffusion process completely. Only a small part of the energy dissipated by the α particle is expended in filling all the traps in a narrow channel, the rest being available for radiative processes. This channel model thus accounts for the almost instantaneous rise of light emission which is observed under irradiation by α particles. (auth)

16545

THE EFFECTS OF IRRADIATION UPON METALS. Frederick Seitz (Univ. of Illinois, Urbana). Trans. Met. Soc. AIME 215, 354–67(1959) June.

The information concerning the generation and the properties of the point imperfections (vacant lattice sites and imperfections) in the noble metals, particularly copper, which is gained from the studies of the effects produced by bombardment is surveyed. It is pointed out that the studies have now reached a stage at which it can be stated with considerable assurance that interstitial atoms migrate at temperatures well below that of liquid nitrogen with activation energies near 0.1 ev. Lattice vacancies can be generated with less energy under equilibrium conditions; however, their activation energy for motion is nearer 0.75 ev. The major part of the effects observed to date in pure monatomic metals at present appears to be ascribable to interstitials and vacancies. (auth)

RADIOACTIVE WASTE

16546 IDO-14458

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

THE ADSORPTION OF RUTHENIUM FROM NITRIC ACID—AIR MIXTURES. D. A. Hanson, B. J. Newby, and K. L. Rohde. June 8, 1959. 70p. Contract AT(10-1)-205. $2.00(OTS).

The adsorption of ruthenium tetroxide on silica gel and other adsorbents from a vapor phase of air—nitric acid—water has been studied to provide design data for a ruthenium adsorber. This adsorber was designed for the off-gas stream of a fluidized bed calciner used to decompose aluminum nitrate fuel reprocessing raffinates but may have broader application. A process has been developed wherein silica gel is used at slightly above the vapor dew point temperature to remove ruthenium preferentially from the off-gas. Decontamination factors of about 1000 are experienced. After saturation of the gel, the ruthenium is removed by washing with a small volume of water and the gel is regenerated by heating in a stream of dry air. Capacities of about 10 g of ruthenium per cubic foot of adsorber have been obtained. This is about 2000 curies per cubic foot with one-year-cooled fission products. Four cycles have been run on the same batch of adsorbent with uniform ruthenium retentions after water washing of about 10 per cent of the total loading. (auth)

16547

PROCESS FOR THE DESTRUCTION OF RADIOACTIVE RESIDUES. L. Verschraeghen. British Patent 802,971. Nuclear Eng. 4, 284(1959) June.

The residual material is exposed to radiation, such as nuclear particles, as a result of which, long-life radioactive constituents are transformed into either stable isotopes or short-life radio-isotopes. After irradiation these isotopes are separated from the remainder by fractionation. Should the remainder still show too high a radioactivity, the material is added to a fresh batch, to be treated and processed a second time. Various methods of processing are described. In the case of a homogeneous reactor, the residue material may be placed in special conduits in the interior of the reactor or, alternatively, if available in the form of gases, liquids or solutions, it may be added to the radioactive material passing through the homogeneous reactor; if available in solid form, it may be incorporated in the control rods. In the case of a heterogeneous reactor, the material to be treated may be placed in recesses of the fuel bars or, where slow neutrons are used, in the body of the graphite moderator.

REACTORS

General

16548 ACPP/P-25
Gt. Brit. Dept. of Atomic Energy. Industrial Group H. Q., Risley, Lancs, England.
THE WITHDRAWAL OF AIR SAMPLES THROUGH LONG PIPES. H. H. Gott and R. H. Peters. Nov. 16, 1948. 5p.

It is shown that for the simultaneous sampling of four pile channels through 1.5 in. diameter pipes 100 feet long it is impossible to extract more than 6% of the flow in any channel and that this is done with such high losses that a sample of more than 3 or 4% should not be called for with this pipe size. The variation in pumping power with sample is given and it is shown that if desirable, this power may be appreciably reduced by a simple cooler for which dimensions are given. (auth)

16549 ANL-6009
Argonne National Lab., Lemont, Ill.
STUDY OF 40 MW PRESSURIZED WATER, BOILING WATER, AND ORGANIC MODERATED REACTORS FOR PRODUCTION OF PROCESS STEAM. L. E. Link, R. H. Armstrong, C. R. Breden, R. J. Gariboldi, L. E. Genens, C. N. Kelber, P. H. Kier, V. M. Kolba, E. L. Martinec, D. R. Patterson, R. R. Rohde, and A. D. Rossin. June 1959. 144p. Contract W-31-109-eng-38. $2.75(OTS).

The study efforts were toward the creation of a reactor design for each of the three types and the development of each concept to a point where the range of costs could be established. The studies presented have high burnup cores of low enrichment in an effort to minimize fuel costs. Of the three designs presented to deliver 1.25×10^5 lb/hr of 380°F steam at 196 psia the PWR core is the most favorable. (W.D.M.)

16550 CF-59-6-47
Oak Ridge National Lab., Tenn.
REMOVAL OF FISSION PRODUCT GASES FROM REACTOR OFF-GAS STREAMS BY ADSORPTION (PRESENTED AT AMERICAN NUCLEAR SOCIETY MEETING, DETROIT, MICHIGAN, DECEMBER 10, 1958). W. E. Browning, R. E. Adams, and R. D. Ackley. June 11, 1959. 36p. Contract [W-7405-eng-26]. $6.30 (ph), $3.00(mf) OTS.

A disposal process is described in which the noble gas fission products, krypton and xenon, are delayed relative to the sweep gas by physical adsorption as they pass through an adsorbent such as activated charcoal. A theoretical expression describing this process was developed, using a theoretical plate analysis, and was verified experimentally. The retention time for a gas present in trace concentration is proportional to the amount of charcoal in the adsorber bed and to the adsorption coefficient which is evaluated experimentally for a particular combination of materials and conditions. The retention time is inversely proportional to the volume flow rate of the sweep gas. The retention times of experimental adsorbers have been measured by a radioactive tracer technique using krypton-85 and xenon-133 to typify fission gases. Retention times were measured for various adsorbents including different grades of activated charcoal, silica gel, activated alumina, and molecular sieve materials. Activated charcoal was the most effective adsorbent. Retention times were measured using helium, hydrogen, argon, nitrogen, oxygen, air, CO_2, Freon-12, and krypton as sweep gases, individually. Water vapor reduces the retention time for krypton on charcoal as does CO_2. Krypton interferes negligibly up to 1000 microns partial pressure. Provision must be made for the dissipation of heat from radioactive decay. Retention time decreases logarithmically as temperature increases. Ignition temperatures in oxygen were determined and methods for prevention and control of charcoal fires were investigated. Experimental results described were used to design off-gas adsorber systems for in-pile experiments and to analyze the performance of an adsorber for a homogeneous circulating fuel reactor. These adsorber systems performed satisfactorily for times in excess of one year. (auth)

16551 CISE-67
Centro Informazioni Studie Esperienze, Milan.
CALCULATION METHODS FOR THE CRITICAL SIZE OF A D_2O MODERATED, WET STEAM COOLED REACTOR, WITH A NATURAL URANIUM CLUSTER FUEL ELEMENT. R. Bonalumi, S. Bruschetti, and G. B. Zorzoli. May 5, 1959. 50p.

Fuel elements and the design of a heavy water moderated, steam cooled reactor are described. Multiplication factors, critical size, and reactivity are evaluated for several lattice spacings. Further developments are also outlined. (auth)

16552 CNC-9
Italy. Comitato Nazionale per le Ricerche Nucleari, Milan.
PROBLEMI TERMICI NELLE STRUTTURE ETEROGENEE. (Thermal Problems in Heterogeneous Systems.) A[rturo] Calori. May 1959. 59p.

Equations for the determination of the reactor heat output and the temperature of the coolant are derived with a consideration of the maximum allowable temperature for the surface and interior of a cylindrical uranium rod. The expression for the temperature at various points of the channel is given as a function of the mean specific extractable heat power. The mean specific thermal power and the total power of the reactor are determined as a function of the coolant flow for a given system geometry. The pumping power for the coolant circulation in a channel is calculated. (J.S.R.)

16553 CRCE-834
Atomic Energy of Canada Ltd., Chalk River, Ont.
THE INTERNAL INSULATION OF REACTOR PRESSURE TUBES. 3. HEAT TRANSFER STUDIES OF LAYERS OF COMPRESSED POWDERS. D. H. Charlesworth. Mar. 1959. 27p. (AECL-828). $1.00(AECL).

The thermal conductivity and the bulk density of layers of alumina, magnesia, silica, talc, and zirconia powders compacted by compressive loads were determined. These measurements were made as the initial part of a program to develop the concept of the Cooled Stress Tube, a reactor pressure tube internally insulated by a layer of compacted powder. The powder is isolated from the coolant by a thin-walled liner and transmits the coolant pressure to the pressure tube. Of the powders tested, magnesia exhibited the best combination of low thermal conductivity and neutron capture. Further tests demonstrated that the thermal conductivity and bulk density of compacted magnesia powder are mainly a function of the maximum compressive stress to which the powder has been subjected. Temperature and pressure cycling, and layer thickness have only a minor effect. The permeability of compacted magnesia powder to a flow of air through it is low. (auth)

16554 JEN-44
Spain. Junta de Energia Nuclear, Madrid.
REACTIVIDAD DE UNA BARRA DE CONTROL "GRIS." (Reactivity of a "Grey" Control Rod.) Luis Alvarez del Buergo and Justo Montero Ponce de León. 1959. 20p.

The reactivity controlled by a black rod is calculated by a method analogous to that developed by Glasstone and Edlund. The results obtained are used to calculate the reactivity of a grey rod. The coefficient of purity, defined as the factor by which the reactivity of a black rod is multiplied in order to obtain the reactivity of a grey rod, is derived. The variation of the coefficient of purity with the percent of boron in the rod is considered. The results show that with 3 or 4% of boron or cadmium in a control rod almost the same reactivity is obtained as with a 100% boron or cadmium rod. (J.S.R.)

16555 NP-7449
Veterans Administration Hospital, Omaha.
APPLICATION FOR CONSTRUCTION PERMIT AND UTILIZATION FACILITY LICENSE. Mar. 24, 1959. 69p. $16.80(ph), $5.70(mf) OTS.

An application is made for a permit to install and operate a 10-kw training, research, and isotope-production reactor (TRIGA) that is being purchased from the General Atomic Division of General Dynamics Corp. Specifications for the reactor and an evaluation of possible hazards are included. The reactor core uses zirconium hydride as moderator and will be equipped with conventional safety rods and electronic scram equipment. (W.D.M.)

16556 NP-7627
Washington. Univ., Seattle. Coll. of Engineering.
UNIVERSITY OF WASHINGTON TRAINING REACTOR PRELIMINARY HAZARDS SUMMARY REPORT. May 1959. 49p. $7.80(ph), $3.30(mf) OTS.

A preliminary report on the site, design, and hazards analysis of the University of Washington Training Reactor (UWTR) is presented. Detailed description of the site is given including maps and a photograph. Also, full discussions of the reactor building and the reactor are given as well as reactor use and personnel organization. (J.R.D.)

16557 ORNL-2616
Oak Ridge National Lab., Tenn.
EXPERIMENTS ON THE RELEASE OF FISSION PRODUCTS FROM MOLTEN REACTOR FUELS. G. E. Creek, W. J. Martin, and G. W. Parker. July 22, 1959. 28p. Contract W-7405-eng-26. $1.00(OTS).

Experiments on the release of fission products in the controlled melting of irradiated fuel of the APPR, STR, and MTR types under conditions simulating the loss-of-coolant accident were performed. The results indicate that a moderate amount of heating in air or steam sufficient only to melt a specimen results in the partial volatilization of the rare gases, the halogens, and the alkali metals. In the presence of air or steam, little of the strontium and other fission products is released. In this type of experiment the only particulate activity observed was composed entirely of cesium. At the level of trace concentration of fission products, APPR plate melted at 1525°C and released 50% of the rare gases, 33% of the iodine, 9% of the cesium, and traces of strontium. After 25% burnup the cesium value rose markedly to 41%, while the iodine value apparently declined to 12%. Aluminum alloy at 700°C released only 2% of the iodine and 10% of the rare gases. Zirconium alloy, after 15% burnup, melted at 1850°C in air and released all of the rare gases, 26% of the iodine, 10% of the cesium, and less than 1% of the strontium. When melted in steam, approximately 2% of the strontium and 0.5% of the barium were also released from zirconium alloy. Exploratory experiments were performed with Geneva-type aluminum-dispersion fuel, UO_2, and GE-HTRE fuel. (auth)

16558 ORNL-2708
Oak Ridge National Lab., Tenn.
DUMP TANK CRITICALITY AND POISONS FOR SLURRY REACTORS. B. E. Prince. July 9, 1959. 28p. Contract W-7405-eng-26. $1.00(OTS).

Criticality conditions in slurry dump tanks and poisoned reactors were investigated in a computational study. The maximum "eversafe" diameters were about 9 in. and 8 in. for infinite H_2O-reflected cylinders containing ThO_2-H_2O slurries having U^{235}-to-thorium mass ratios of 0.10 and 0.15, respectively. The corresponding maximum thicknesses of infinite slabs with infinite H_2O reflectors were very nearly one-half the cylinder diameters. The amount of natural boron required to decrease the critical temperature from operating conditions to 20°C was calculated for three slurry reactors. (W.D.M.)

16559 ORNL-2716
Oak Ridge National Lab., Tenn.
PROJECT AQUARIUM: LABORATORY AND FIELD CORROSION TESTS FOR THE GENEVA CONFERENCE REACTOR. J. L. English, A. R. Olsen, and E. G. Bohlmann. July 9, 1959. 62p. Contract W-7405-eng-26. $1.75(OTS).

The unfavorable corrosion behavior of a group of Geneva Conference Reactor fuel elements during criticality tests in the Bulk Shielding Facility prompted a laboratory and field investigation to determine the cause or causes for the observed behavior. The laboratory tests were conducted in distilled water with source materials of 1100 aluminum used in the fabrication of Geneva and other types of fuel elements. The field tests were run in demineralized cooling water at the Bulk Shielding Facility with dimensionally rejected Geneva elements. Relatively brief exposure periods in the laboratory tests resulted in an average corrosion rate of 0.6 mpy for 1100 aluminum; the rate decreased with time. In one case, severe pitting attack was traced to iron contamination on the surface of the aluminum. An extended pickling time with sulfuric-chromic acid solution to remove the contamination was effective in eliminating the attack. There was an indication that the nitric-hydrofluoric acid pickling solution used during the fabrication of Geneva elements instigated pitting attack on aluminum. The silicon–aluminum alloy used to braze the fuel plates to the aluminum side plates was found to be highly susceptible to pitting attack in distilled water. In the field tests, during exposure periods of several months in demineralized cooling water, numerous pits penetrating 50% of the 17.5-milthick aluminum cladding on Geneva elements were observed; in one case, a 62% penetration occurred in 45 days. Some evidence was obtained that the effect of water flow was to minimize pitting attack and staining on an irradiated fuel element exposed in demineralized water. (auth)

16560 WAPD-RM-197
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
SUPPLEMENTARY REPORT ON REACTOR HAZARDS ASSOCIATED WITH THE TWO REGION REACTOR (TRX). A. F. Henry and J. J. Taylor. Sept. 1953. Decl. Oct. 27, 1958. 51p. Contract AT-11-1-GEN-14. $7.80(ph), $3.30(mf) OTS.

The nature of a nuclear runaway and hazards to the surrounding area due to diffusion of radioactive material were studied. The magnitude of the energy release during a nuclear incident appears to have been overestimated in an earlier report. The radiation hazards to the surrounding area in the event of a runaway were reexamined using the Sutton theory of atmospheric diffusion. The dosages due to gamma radiation, beta radiation, and internal ingestion were examined separately. The conclusion is that in general the beta radiation represents the most significant hazard at distances corresponding to the boundaries of the controlled area and greater. (A.C.)

16561
PHYSICS AND HEAT TECHNOLOGY OF REACTORS. Translated from Suppl. No. 1 of Atomnaya Energ. New York, Consultants Bureau, Inc., 1958. 177p.

A collection of 19 papers concerning problems of reactor construction is presented. The collection may be divided into two groups. The first group is concerned with reactor physics calculations, reactor experiments, and reactor safety. The second group is concerned more with problems of an engineering nature, especially heat removal from power reactors. Consideration is also given to radioactivity buildup in cooling systems. (A.C.)

16562
DESIGN AND CONSTRUCTION CRITERIA FOR IN-PILE EXPERIMENTAL CHEMICAL REACTORS. D. J. Daniels, M. C. Schroeder, D. D. Foley, and R. B. Filbert, Jr. (Battelle Memorial Inst., Columbus, Ohio). Chem. Eng. Progr. 55, Symposium Ser. No. 22, 83-9(1959).

Problems encountered in design and construction of chemical processing loops for operation in Battelle's reactor are described. Recommendations are given for general design criteria, dimensional considerations, selection of materials, safety considerations, radiation heat generation, and removal and disposal of in-pile assembly. (T.R.H.)

16563
WIGNER RELEASE IN GRAPHITE-MODERATED REACTORS. [PART] I. C. Dalmasso (AGIP Nucleare, Milan) and G. F. Nardelli (Università, Milan). Energia nucleare (Milan) 6, 307-21(1959) May. (In Italian)

The behavior of irradiated graphite in annealing experiments is studied from the viewpoint of Wigner release. The physical situation in an irradiated crystal is examined with regard to the system of lattice defects induced by neutron radiation, and the behavior of macroscopic properties during annealing experiments is studied in some simple cases. Large irregular regions, which are always present in a strongly irradiated crystal, suggest that the phenomenological theory of annealing by processes distributed in activation energy is a good approximation to describe such phenomena, as it was suggested in early experimental work. (auth)

16564
EVALUATION OF MATERIAL WEAR AND SELF-WELDING IN SODIUM-COOLED REACTOR SYSTEMS. R. B. Jerman (Allis-Chalmers Mfg. Co., Milwaukee) and R. C. Williams and D. O. Leeser (Atomic Power Development Associates, Inc., Detroit). J. Basic Eng. 81, 213-25(1959) June.

Laboratory and prototype component tests were made to determine the degree of adhesion and self-welding of various bearing-couple materials in liquid Na. A few tests were run in N_2 and Ar. Temperatures were from 500 to 1000°F and the static loads on the bearing surfaces were up to 10,000 psi. The harder materials showed better wear resistance than did softer materials. (auth)

16565
INTERNAL INSPECTION OF FAST REACTOR FUEL ELEMENTS. C. D. Reid (United Kingdom Atomic Energy Authority, Capenhurst, Ches., Eng.). Nuclear Power 4, No. 37, 109-10(1959) May.

A proposed inspection program for fuel elements in the Dounreay Fast Reactor is discussed. Prototype apparatus designed to provide optical inspection of the bore of the inner tube is described. (A.C.)

16566
SRE DECAY-HEAT PROBLEM SOLVED BY EDDY-CURRENT BRAKE. W. S. De Bear (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nucleonics 17, No. 6, 108-9, 111-13 (1959) June.

When the reactor is shut down, circulation of sodium through the reactor is by thermal convection. The result is that sodium at a relatively low temperature is brought into contact with piping that is still at a high temperature, thereby leading to excessive thermal stresses. These stresses were minimized by installing two eddy-current brakes to control flow in proportion to heat generation, resulting in constant temperature gradients. The operation of these eddy-current brakes is described. (A.C.)

16567
WHICH FOR MINIMUM FUEL COST—ZIRCALOY OR STAINLESS CLAD? Norman Beecher (National Research Corp., Cambridge, Mass.) and Manson Benedict (Massachusetts Inst. of Tech., Cambridge). Nucleonics 17, No. 7, 64-7; 100(1959) July.

Costs were compared, based on recent AEC prices, for Zircaloy-2 and stainless steel cladding in a pressurized water reactor. Zircaloy-2 offers a lower fuel cost for burnups > 12,000 Mwd/ton. Nomenclature, basic prices, and other data are listed. (A.C.)

16568
RELATING BASIC CORE PARAMETERS. R. C. Walker (General Electric Co., Richland, Wash.). Nucleonics 17, No. 7, 68(1959) July.

Parameters common to all reactors in which parallel process channels are arranged in a symmetrical lattice in a cylindrical core are shown on a chart. For lattice shells that are not squares or equilateral triangles, the designer can compute the equivalent square lattice area and then use the chart directly. (A.C.)

16569
DETERMINING CLADDING THICKNESS OF FUEL ELEMENTS BY X-RAYS. Beverley James Lowe, Payson D. Sierer, Jr., and Robert B. Ogilive (Massachusetts Inst. of Tech., Cambridge). Nucleonics 17, No. 7, 70; 72(1959) July.

The application of x-ray fluorescent techniques to the measurement of fuel element cladding thickness is discussed. The conclusion is reached that these techniques are feasible for continuous quality control but that equipment must be designed for such processes. The results of experimental studies are graphically shown. (A.C.)

16570

USE OF LESS EXPENSIVE RARE EARTHS AS CONTROL MATERIALS. J. A. Ransohoff. Nucleonics 17, No. 7, 80-2; 84(1959) July.

The rare earths europium, gadolinium, samarium, dysprosium, and erbium are discussed as possible control rod materials. Tabulations are given of physical and nuclear properties, cost, and availability. (A.C.)

16571

ESCAPE OF VIRGIN NEUTRONS. R. Kladnik (Inst. "J. Stefan," Ljubljana, Yugoslavia). Nucleonics 17, No. 7, 85-7(1959) July.

Previous authors have used the method of numerical integration in calculating the collision probability P. A method is described that expresses P as a suitable convergent series to avoid the numerical-integration method. A tabulation compares the resultant average probability P obtained by the series method with P obtained by the numerical integration method. (A.C.)

16572

BASIC PRINCIPLES OF THE CONTROL OF A NUCLEAR REACTOR, USING SAPHIR AS AN EXAMPLE. H. Winkler. Reaktor Bull. No. 7, 1-8(1959) Jan. (In German)

The principles of reactor control are clarified, and the results obtained are applied to operating apparatus. As an example of an existing plant, the SAPHIR reactor was selected. The dynamic behavior of chain reactions and control apparatus of a reactor are discussed. The instrumentation used for startup, operating control, safety, radiation survey, and auxiliary equipment in the SAPHIR are briefly reviewed. (J.S.R.)

16573

PROGRESS ON DISPERSION ELEMENTS. C. E. Weber (Knolls Atomic Power Lab., Schenectady, N. Y.). p.295-362 of "Progress in Nuclear Energy, Series V, Vol. 2. Metallurgy and Fuels." New York, Pergamon Press, 1959.

Recent progress in theory, fabrication, and application of dispersion elements is reviewed. Both boron and uranium-containing elements were studied and applied to reactor use. Advances in dispersion theory plus supporting equations, figures, and tables are discussed, which provide an improved basis for choice of particle size, composition, and matrix material, plus a clearer distinction between dispersion and non-dispersion systems. Data on the effect of fission of B^{10} or U^{235} on element performance are summarized with respect to performance criteria such as changes in mechanical and physical properties, and dimensional stability to accumulation and agglomeration of fission products. Summary tables of types of systems that can be or have been studied as the dispersed fissile phase are included with appropriate literature references. Fabrication procedures applied to dispersion elements are reviewed in detail, emphasizing both the processes and the relationship between process variables and subsequent element quality and performance. (auth)

16574

NUCLEAR REACTOR CONTROL AND INSTRUMENTATION. NUCLEAR ENGINEERING MONOGRAPHS. J. H. Bowen and E. F. O. Masters. London, Temple Press, Ltd., 1959. 85p.

The operating characteristics of gas-cooled graphite-moderated reactors and their associated control and instrumentation are discussed. The effects of reactivity changes and cooling rate and some special problems connected with control rods and trip circuits are described. (A.C.)

16575

NUCLEAR REACTOR SHIELDING. NUCLEAR ENGINEERING MONOGRAPHS. J. R. Harrison. London, Temple Press, Limited, 1958. 74p.

An introduction to the principles and practice of nuclear reactor shielding is presented. Nuclear reactor shielding, gamma-ray attenuation, neutron physics, shield design, and miscellaneous topics are discussed. (A.C.)

16576

PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957. G. W. Wensch, ed. Washington, D. C., U. S. Atomic Energy Commission. 286p. $2.00 (GPO).

The purpose of the meeting was to describe the status of the Fast Breeder Reactor Programs and Fast Reactor Safety Programs for the benefit of access permit holders from industry who have expressed interest in these programs. Thirty-one papers were presented by members of the staff of ANL, LASL, PRDC, and USAEC. One paper on the UK Fast Reactor Program was given. (W.D.M.)

16577

ANL FAST REACTOR PROGRAM. L. J. Koch (Argonne National Lab., Lemont, Ill.). p.7-8 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

ANL is conducting a very broad program in fast reactor development. It includes all of the major scientific and engineering disciplines in the Laboratory, and it encompasses all of the phases of power reactor technology as well as fuel processing and fabrication. The major effort is directed toward solid metal fuel, heterogeneous, fast power reactors. The immediate emphasis is on the design, development, and construction of EBR-II. (W.D.M.)

16578

LOS ALAMOS SCIENTIFIC LABORATORY FAST REACTOR PROGRAM. D. B. Hall (Los Alamos Scientific Lab., N. Mex.). p.9-11 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

LASL is concerned with the development of molten plutonium fueled reactors cooled with liquid metal and surrounded by a fertile blanket of uranium. The fundamental properties of Pu alloys are under investigation with particular emphasis on those with melting points below 800°F and with Pu content in the range 20 to 90 at. %. Associated with the fuel development is a vigorous attack on the important problem of fuel handling and reprocessing. The problems involved in fast reactor safety are being considered. (W.D.M.)

16579

THE POWER REACTOR DEVELOPMENT COMPANY FAST REACTOR PROGRAM. J. F. Anderson (Power Reactor Development Co., Detroit). p.12-14 of PRO-

CEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

PRDC is a nonprofit membership organization dedicated to an early demonstration of the practical and economical utilization of nuclear energy for the production of electric power. To this end PRDC is engaged in the construction of a full-scale developmental fast neutron breeder reactor, the Enrico Fermi Atomic Power Plant. The over-all responsibility for the design, financing, construction, and operation of the reactor portion of the plant lies with PRDC; however, the coöperative assistance of Atomic Power Development Associates, Inc., The Detroit Edison Company, and the AEC are vital parts of the over-all program. The project responsibilities of these organizations and the highlights of the PRDC project to date are outlined. (W.D.M.)

16580

ENGINEERING DESIGN OF EBR-II. (Reactor and Power Cycle). H. O. Monson (Argonne National Lab., Lemont, Ill.). p.15-22 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

The EBR-II is an integral nuclear power plant, i.e., it includes a complete fuel processing and fuel element fabrication facility in addition to the reactor, the heat transfer systems, and a steam-electric plant. Engineering design and component development are presently nearing completion. Construction of the plant has started, and operation is expected to begin in 1960. The plant as a whole is described very briefly, with particular emphasis on the power cycle. (W.D.M.)

16581

ENGINEERING DESIGN OF EBR-II. (Fuel Process and Fabrication Cycle). M. Levenson (Argonne National Lab., Lemont, Ill.). p.23-8 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

The EBR-II, in addition to demonstrating advances in reactor technology, will demonstrate the use of a closed fuel cycle. The fuel cycle selected for inclusion in the EBR-II plant is designed for remote operation. Fuel processing will be done by melt refining and fuel fabrication by injection casting. The facilities are being designed to achieve maximum flexibility while the equipment is being designed as specific and simple as possible. The 16-sided shielded shop is described. (W.D.M.)

16582

DESIGN OF THE ENRICO FERMI ATOMIC POWER PLANT. A. Amorosi (Atomic Power Development Associates, Inc., Detroit). p.29-62 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

The arrangements of the reactor and power plant are shown. The core is about 2½ feet in diameter and 2½ feet high. The radial blanket is 2 feet thick, and the axial blanket is 1½ feet thick. The coolant flow is up through the core. The primary system sodium flows by gravity from the reactor through the intermediate heat exchanger into the pump tank. The heat exchangers are arranged to take care of the decay heat by natural circulation. The fuel and blanket subassemblies are shown. Construction progress is discussed. (W.D.M.)

16583

FAST REACTOR SAFETY; EBR-I. F. W. Thalgott (Argonne National Lab., Lemont, Ill.). p.68-76 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

Experience with EBR-I as it applies to fast reactor safety especially with regard to the stability of fast reactors is discussed. The history of EBR-I and its role in the fast reactor program are given. Design features of EBR-I, Marks I, II, and III, are illustrated. A phenomenon observed in EBR-I was an oscillation in power which occurred when operating conditions were made severe. This phenomenon, which led to core meltdown is discussed. (W.D.M.)

16584

MELTDOWN AND ANALYSIS. D. Okrent (Argonne National Lab., Lemont, Ill.). p.77-81 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

The various ways in which core meltdown could occur and the possible courses for a meltdown to follow are discussed. The question of present danger areas in design is considered. Experiments for studying meltdown in the Transient Reactor Test Facility are discussed. (W.D.M.)

16585

ANALYSIS OF PROMPT EXCURSIONS IN SIMPLE SYSTEMS. W. R. Stratton and T. H. Colvin (Los Alamos Scientific Lab., N. Mex.). p.82-92 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

Godiva is a bare, 94% enriched uranium metal assembly which is fabricated in three sections that go together to form a sphere. The total mass of the system is about 55 kg. The system is normally assembled by remote control, and any experiments are monitored by counters, detectors, and closed circuit television. A calculation, coded for a fast computer, that can fairly accurately match the experimental results obtained from the LASL Lady Godiva prompt burst program is described. The code can predict the reactivity, burst width, and maximum rates with reasonable accuracy. (W.D.M.)

16586

NUCLEAR ANALYSIS (CRITICAL EXPERIMENTS WITH ZPR-III). R. R. Smith (Argonne National Lab., Lemont, Ill.). p.96-100 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

ZPR-III was designed specifically for the simulation and study of fast reactor cores fueled either with U^{235} or Pu^{239}. Details of its construction and operation are presented. The types of experiments conducted with this facility and the reasons why these experiments are conducted are discussed. Experiments conducted thus far may be grouped under three general categories according to whether they provide fundamental, engineering, or pure physics data. (W.D.M.)

16587

NUCLEAR ANALYSIS (STATICS ANALYSIS). W. B. Loewenstein (Argonne National Lab., Lemont, Ill.). p.101-7 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

Two principal topics, demonstrating the primary functions of a program to predict the static behavior of a system, are discussed. First, where does the critical assembly information fall into this pattern of analysis? Second, what sort of agreement can be obtained between theory and experiment after a few critical experiments have been done? (W.D.M.)

16588

REACTOR DESIGN AND ANALYSIS; LAMPRE I. R. E. Peterson (Los Alamos Scientific Lab., N. Mex.). p.108-17 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

The objectives in the construction and operation of LAMPRE-I are to test fuel containment, fuel purity control, and a form of fuel transfer. Additional information will be obtained on factors affecting reactivity control and heat transfer. The proposed model is based on the use of Pu–Fe fuel alloy, with a melting point of about 410°C, held in tantalum. The 1 Mw reactor is sodium cooled and reflector controlled. (W.D.M.)

16589

REACTOR DESIGN AND ANALYSIS; EBR-II. W. R. Simmons (Argonne National Lab., Lemont, Ill.). p.118-30 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

The EBR-II is a sodium-cooled unreflected fast breeder type reactor. The initial core loading will be U–5 wt. % fissium, and subsequent loadings will be U–20 wt. % Pu–10 wt. % fissium. The expected breeding ratios with these fuels are 1.2 and 1.6, respectively. Initial operation will be limited to 45 Mw. Design is discussed in terms of the reactor, primary coolant system, control and safety rod system, and power density and temperature distribution. (W.D.M.)

16590

REACTOR DESIGN AND ANALYSIS: ENRICO FERMI REACTOR. J. B. Nims (Atomic Power Development Associates, Inc., Detroit). p.131-43 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

The Fermi Reactor is a sodium-cooled fast breeder fueled with a solid uranium alloy. The core is approximately cylindrical, 2.5 ft. in height and diameter. Surrounding the core on all sides is a breeding blanket of depleted uranium of slightly less than 50% normal density. The fuel element design and cooling are discussed. Nuclear characteristics, control system parameters, control reactivity requirements, and the effects of temperature on reactivity are given. (W.D.M.)

16591

FUEL CYCLES; FUEL ELEMENT DESIGN. W. N. McDaniel (Atomic Power Development Associates, Inc., Detroit). p.149-54 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

Considerations which enter into the design of fixed fast reactor fuel elements and subassemblies are discussed. The likenesses and differences in the ANL and APDA design approaches are compared. (W.D.M.)

16592

EBR-II FUEL CYCLE (FUEL CYCLE PLANT AND PROCESS). J. H. Schraidt (Argonne National Lab., Lemont, Ill.). p.155-63 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

The EBR-II system provides for a closed fuel cycle. Remote fabrication appears to be necessary because of the high decontamination factors required for direct refabrication. The fuel cycle steps discussed include: cooling for 15 days, transfer to the process building, disassembly, decladding, and melt refining and casting of the ingot. (W.D.M.)

16593

REMOTE FUEL ELEMENT FABRICATION AND ASSEMBLY. A. B. Shuck and E. S. Sowa (Argonne National Lab., Lemont, Ill.). p.164-71 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

The pyrometallurgically refined billets produced by the melt refining of irradiated EBR-II fuel elements must be remanufactured into fuel elements suitable for use in the reactor. The fuel for the EBR-II is in the form of cylindrical rods 0.144 ± 0.001 inch in diameter by 14.22 ± 0.032 inches long. Casing, cutting, and canning the fuel pins are discussed. Reassembly into fuel subassemblies and return to the reactor are reviewed. (W.D.M.)

16594

MOLTEN PLUTONIUM FUEL DEVELOPMENT (METALLURGY). R. M. Bidwell (Los Alamos Scientific Lab., N. Mex.). p.172-8 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

The Los Alamos work on liquid Pu as a reactor fuel has been primarily concerned not with the element itself, but with certain low-melting alloys. The most promising fuel alloys to date have been the eutectics of Pu with Fe, Co, and Ni. Phase diagrams are given for the three systems. For a large power station reactor, a more dilute Pu melt would be desirable from a heat transfer point of view. For this reason the Pu–Mg monotectic at 85 at. % Mg was investigated. Compatibility tests with W, Mo, Ta, and Nb are reviewed, and the TiPu (tipping plutonium) apparatus is described. (W.D.M.)

16595

FUEL HANDLING AND PROCESSING. W. R. Martini (Los Alamos Scientific Lab., N. Mex.). p.179-81 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

Present research at Los Alamos on handling liquid fuels in a reactor and means of reprocessing molten Pu alloys is intended to result in better realization of the high burnup potentialities of fast reactors. All of the work in this field at LASL is in a very preliminary or exploratory stage, so only an indication of the type of experiments underway is given. (W.D.M.)

16596

FUEL CYCLES; IRRADIATION AND THERMAL STABILITY. J. H. Kittel (Argonne National Lab., Lemont, Ill.). p.182-88 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

In general, fast reactors operate at higher heat fluxes, higher fuel temperatures, and higher burnups than do most thermal reactors. For economical operation and efficient breeding, the expected lifetime must be relatively long, on the order of at least 2 at. % burnup, or 20,000 Mwd/t of fuel. The present status of information obtained in the U. S. on irradiation and thermal effects on fast reactor fuels is reviewed. The data which are presently available have been obtained principally in connection with the development of EBR-I, EBR-II, Fermi Reactor, and the Fast Oxide Breeder (KAPL). (W.D.M.)

16597

COMPONENTS: PUMPS. R. A. Jaross (Argonne National Lab., Lemont, Ill.). p.199-204 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

Several notable advancements in the field of sodium pump technology have been made in the past year. The successful testing of two 5,000 gpm, 40 psi head pumps at ANL has afforded much valuable information and added greatly to the store of experience needed in sodium coolant system design. Extensive tests on these two pumps, one a centrifugal sump type and the other an AC linear induction pump, were made to assist in the selection of pumps for EBR-II. The pumps are described and tests are reviewed. (W.D.M.)

16598

COMPONENTS: PIPING SYSTEM COMPONENTS. F. A. Smith (Argonne National Lab., Lemont, Ill.). p.205-14 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

The EBR-I indicates that reliability in a liquid metals system has been achieved. The components of a sodium piping system are comparable to conventional components. Nearly all the sodium system component items are commercially available and are competitively priced. The present state of development of the piping components other than nuclear cores or steam generators does indicate that there is no serious technical or economical limitation for the reliable operation of sodium piping components at temperatures up to 1,000°F. (W.D.M.)

16599

HEAT EXCHANGERS AND STEAM GENERATORS. R. H. Anderson (Atomic Power Development Associates, Inc., Detroit). p.215-28 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

The philosophy for the use of, and the safety considerations for, the two coolant systems are presented. For the intermediate heat exchangers the basic over-all design considerations for the Fermi Reactor, EBR-II, and LAMPRE-II are discussed. The general design considerations, operating conditions, design features, and descriptions of the liquid metal steam generators are given. Test units operated by APDA and LASL are described. (W.D.M.)

16600

COMPONENTS—HIGH PURITY SODIUM SYSTEMS. Joseph E. Kemme (Los Alamos Scientific Lab., N. Mex.). p.229-33 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

A series of small, pumped, sodium loops was used to study the problems peculiar to a LAMPRE-type reactor. The ultimate purpose of these experiments is to discover a means of purifying sodium which also will protect the plutonium fuel. A description and results of the tests are given. (W.D.M.)

16601

ADVANCED PLUTONIUM REACTOR CONCEPTS. R. P. Hammond (Los Alamos Scientific Lab., N. Mex.). p.238-47 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

Some of the characteristics which economic fast reactors must approach and which are beginning to be achieved in some advanced concepts are listed and discussed. Specific plutonium reactor systems considered are LAMPRE-II, Paste Fuel Reactor (settled slurry), and Equilibrium Reactor (multi-zoned fluid fuel). (W.D.M.)

16602

FLUID FUELS. B. M. Abraham (Argonne National Lab., Lemont, Ill.). p.248-53 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

Slurries in general are discussed, and their apparent advantages for fast reactor application are reviewed. Experiments on UO_2—NaK slurries are described. A slurry of NaK—5 vol. % UO_2 has been circulated successfully for long periods of time at 500°C. Erosion and corrosion do not appear to be a problem. The UO_2 is readily resuspendable after it has been permitted to settle either hot or cold. One preliminary experiment with a 15 vol. % slurry, which begins to approach the concentration of interest for a fast reactor, showed that the suspension was still fluid and it appeared uniform as it was circulated around the loop. (W.D.M.)

16603

ADVANCED FAST REACTOR DEVELOPMENT, PLUTONIUM—URANIUM ALLOY METAL SYSTEMS. R. J. Dunworth and L. R. Kelman (Argonne National Lab., Lemont, Ill.). p.254-6 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

The data obtained so far on the U—Pu and 70 wt. % U—20 wt. % Pu—10 wt. % fissium alloys are presented. The binary composition is one of the worst alloys tested, but the ternary fissium alloy is about the best alloy examined to date. Properties of the EBR-II fuel alloy reported on include casting, extrusion, rolling, hardness, thermal expansion, thermal conductivity, and corrosion resistance. (W.D.M.)

16604

FUEL ELEMENT CONCEPTS. C. M. Ladd (Atomic Power Development Associates, Inc., Detroit). p.257-62 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

The fuel element concepts that have evolved from the programs at ANL, APDA, and KAPL are: (1) variations of the shell and tube radiator design using a sodium thermal bond; (2) the sodium-bonded flat plate radiator design; (3) the sodium-bonded pin element design used by ANL; (4) the metallurgical bonded plate subassembly proposed by BMI for the APDA Core II program; and (5) the gas-bonded pin element design studied by KAPL. The advanced fuel element designs developed by these three projects are discussed. (W.D.M.)

16605

FUEL AND BLANKET PROCESS DEVELOPMENT. L. Burris, Jr. (Argonne National Lab., Lemont, Ill.). p.263-71 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, Ill., NOVEMBER 20-21, 1957.

With the emphasis on the importance of the over-all fuel cycle in fast reactors, attention is now being focused on one of the steps within the fuel cycle—fuel reprocessing. Major types of fuel processing are discussed, with emphasis being given to the more recent development of pyrometallurgical processes which have many potential advantages in processing fast reactor fuels. Types discussed include solvent extraction, fluoride volatility processes, pyrometallurgical process development, fractional distillation or sublimation, fractional crystallization, liquid-liquid extraction, cyclic oxidation and reduction, and electrochemical. (W.D.M.)

16606
COUPLED FAST-THERMAL REACTOR. R. Avery (Argonne National Lab., Lemont, Ill.). p.272-5 of PROCEEDINGS OF THE 1957 FAST REACTOR INFORMATION MEETING HELD AT CHICAGO, ILL., NOVEMBER 20-21, 1957.

The primary interest in coupling a thermal reactor to a fast reactor is to obtain a system combining high breeding and long neutron lifetime. It is hoped that this can be achieved without sacrificing too much breeding gain. A conceptual design of a coupled system operating as a power breeder is presented. The design consists of a fast core surrounded by an inner blanket of natural uranium. Outside this inner blanket is a moderator region surrounded by a depleted uranium blanket. Below and above the fast core is a normal blanket containing no moderator. (W.D.M.)

16607
NUCLEAR REACTOR CONTROL MECHANISM. R. G. Noakes, C. D. Boadle, and Rolls-Royce, Ltd. British Patent 803,708. Nuclear Eng. 4, 284(1959) June.

In nuclear reactors of the solid-moderator type a considerable amount of space is required solely for the purpose of accommodating the conventional control rod arrangement. In order to economize in space it is proposed to use control elements of part-cylindrical form, the size of a quadrant for instance, which are mounted in the reflector body in an upright position and can be rotated by means such as a spindle around their (vertical cylinder) axis in a path specially cut into the reflector mass. Thus, in action, the cylinder section forming the control element (and made from material of high neutron absorbing capacity such as cadmium or boron) would be in a position between the reflector body and core, intercepting neutrons before they can reach the reflector mass, whereas when not in use, the element would be positioned between reflector body and pressure vessel wall, permitting the respective area of the reflector mass to function normally.

16608
NUCLEAR REACTOR INSTALLATIONS. (to Rudolf Schulten). British Patent 816,083. July 8, 1959.

A proposal is made which involves dissolving a neutron-absorber material such as BF_3 or HBO_3 in the secondary coolant gas or liquid to capture delayed neutrons and prevent activation. (T.R.H.)

16609
IMPROVEMENTS IN OR RELATING TO FUEL ELEMENTS. Leslie Mark Wyatt (to United Kingdom Atomic Energy Authority). British Patent 816,124. July 8, 1959.

A cylindrical fuel element with a longitudinally finned jacket is provided with a helical fin with slots in it for the longitudinal fins. Thus longitudinal growth takes place without distortion, and bowing is lessened by the helical fins. (T.R.H.)

Power

16610 AECU-3952 (2nd. Issue)
Duquesne Light Co., Shippingport, Penna.
INITIAL RADIATION SURVEY. SECTION I. Test Results DL-S-172 (T-612084). First Issue, July 30, 1958. Second Issue, Apr. 28, 1959. 20p. $3.30(ph), $2.40(mf) OTS.

The radiation levels in the Reactor Plant Boiler Chambers during plant operation were determined. The boiler chamber concrete shielding affords adequate protection for personnel working on an isolated coolant loop while the remaining loops are in service. The survey indicated that the radiation level in the isolated loop was very low. Power levels ranged between 80 to 90%. (auth)

16611 AECU-4005 (2nd. Issue)
Duquesne Light Co., Shippingport, Penna.
FLOW DISTRIBUTION ACROSS THE CORE. SECTION II. Test Results DL-S-182 (T-550097). First Issue, Jan. 13, 1959. Second Issue, Apr. 21, 1959. 13p. $3.30(ph), $2.40(mf) OTS.

The flow mixing characteristics of the lower plenum appear to be quite small. The temperature indicated by the thermocouple nearest the cold loop decreased approximately 15°F. The cold loop temperature was 15°F below the initial reactor coolant average temperature when the cold loop was placed in service. The thermocouple most remote from the cold loop showed little or no change in temperature. The rate of change of reactor coolant temperature for pumps on "SLOW" speed was always less than that for pumps on "FAST" speed during comparable runs. (auth)

16612 AECU-4191
Duquesne Light Co., Shippingport, Penna.
DETERMINATION OF COEFFICIENTS OF REACTIVITY. SECTION I. SIXTH PERFORMANCE. Test Results DL-S-151 (T-550132). First Issue, Apr. 30, 1959. 38p. $6.30(ph), $3.00(mf) OTS.

The temperature and pressure coefficients of reactivity at zero power were determined. The magnitude of the temperature coefficient at the plant operating temperature (500°F) was $-1.70\ (\Delta\rho/\Delta T) \times 10^{-4}$ after 2790 EFPH. At the last performance of this test the temperature coefficient was $1.925\ (\Delta\rho/\Delta T) \times 10^{-4}$ (uncorrected). The new temperature coefficient indicates continued stable reactor operation at the present plant operating conditions. The determination of the pressure coefficient was omitted from this performance. (auth)

16613 AECU-4192
Duquesne Light Co., Shippingport, Penna.
XENON TRANSIENT TEST. SECTION I, ADDENDUM. FIRST PERFORMANCE. Test Results DL-S-156 (T-612081). First Issue, Apr. 30, 1959. 6p. $1.80(ph), $1.80(mf) OTS.

The control rods after a safety shutdown from 52 per cent power were calibrated. The rod worth of the light control rods on inverters 2 and 6 was $11.56 \times 10^{-4}\ \Delta\rho$/inch at a height of 26.75 inches. The reactor was shutdown from 51.8% power and then brought critical at 1×10^{-10} amps on normal programming, with the 1A, 1B, and 1D coolant loops in service. The rods were adjusted to achieve start-up rates of 0.8 to 1.3 decades/minute. At no time during the measurements was the power level allowed to exceed 1×10^{-7} amps as per the intermediate range instrumentation. The xenon transient was followed for approximately thirty minutes. The intermediate range instrumentation was used to obtain the start-up rates. (auth)

16614 AECU-4193
Duquesne Light Co., Shippingport, Penna.
PERIODIC RADIATION SURVEY OF REACTOR PLANT CONTAINER AND COMPONENTS AFTER SHUTDOWN "E" SURVEY. SECTION III. FIRST PERFORMANCE.

Test Results DL-S-184 (T-612076). First Issue, Apr. 28, 1959. 16p. $3.30(ph), $2.40(mf) OTS.

The gamma spectrometer surveys of the hairpin loop were found to be of no value since no peaks were observed, and therefore, the data could not be compared with the radiochemical analysis of the pipe sample. Erroneous and misleading results were obtained from the "loose material analysis" since steel filings were introduced and some samples lost on the brush. (auth)

16615 AECU-4194
Duquesne Light Co., Shippingport, Penna.
REACTOR PLANT CONTAINER-AIR LOCKS AND 48-INCH BUTTERFLY VALVES LEAKAGE AND PERFORMANCE TEST. SECTION I. Test Results DL-S-206 (T-641103). First Issue, Apr. 30, 1959. 14p. $1.80(ph), $1.80(mf) OTS.

The efficiency of each of the six air locks was proven by means of an air pressure test, visual inspection, and operating check. (J.E.D.)

16616 AECU-4195
Duquesne Light Co., Shippingport, Penna.
OPERATIONAL RADIATION MONITORING SYSTEM METER AND RECORDER CORRELATIONS. SECTION I. Test Results DL-S-270-S (RNI-14). First Issue, Apr. 28, 1959. 5p. $1.80(ph), $1.80(mf) OTS.

The discrepancies between the operational radiation monitoring system indicating meter and recorder readings were examined. The recorder reading variation ranged from −28% to +30% of the indicating meter readings. The recorder and meter readings could be made to agree by changing the value of the computer indicator circuit dropping resistors. (J.R.D.)

16617 AECU-4196
[Los Alamos Scientific Lab., N. Mex.]
THE POTENTIALITIES OF NUCLEAR PROPULSION FOR SPACE FLIGHT. R. E. Schreiber. May 1, 1959. 19p. [Contract W-7405-eng-36]. $3.30(ph), $2.40(mf) OTS.

A speech delivered at the American Physical Society meeting held in Washington.

The basic considerations of rocket propulsion are reviewed, and the potentialities of nuclear propulsion are discussed. Neither nuclear nor reactor physics is discussed. (A.C.)

16618 AECU-4197
Duquesne Light Co., Shippingport, Penna.
ACTIVATION AND TRANSPORT OF LONG-LIVED CORROSION PRODUCTS. SECTION I. FOURTH, FIFTH, SIXTH, SEVENTH, AND EIGHTH PERFORMANCES. Test Results DL-S-198 (T-641107). First Issue, Apr. 28, 1959. 10p. $1.80(ph), $1.80(mf) OTS.

The mechanisms of activation and transport of corrosion products under the reference water conditions of the Shippingport Pressurized Water Reactor are discussed. (auth)

16619 AECU-4198
Duquesne Light Co., Shippingport, Penna.
SIMULATED REACTOR COOLANT LEAK. SECTION II. Test Results DL-S-228 (T-612388). First Issue, Apr. 30, 1959. 6p. $1.80(ph), $1.80(mf) OTS.

The plant response to a simulated major rupture in the reactor coolant system was determined. The adequacy of the procedure for handling the situation for maintaining the plant safety is evaluated. (J.E.D.)

16620 ANL-5849
Argonne National Lab., Lemont, Ill.
DYNAMIC BEHAVIOR OF BOILING REACTORS. J. A. Thie. May 1959. Includes Appendices: A. REACTOR MECHANICAL DATA. J. A. Thie. B. REACTOR PHYSICS. J. A. Thie. C. REACTOR HYDRAULICS. J. Marchateree. D. DERIVATION OF HARMONIC CONTENT IN THE POWER DUE TO A SINUSOIDAL REACTIVITY VARIATION. J. A. Thie. E. GENERALIZED THEORY OF FEEDBACK. Z. Akcasu and J. A. Thie. 51p. Contract W-31-109-eng-38. $1.50(OTS).

Eight boiling reactors, BORAX I, II, III, IV, EBWR, LITR, VBWR, and SPERT I, have been operated to date, and a considerable amount of information exists in regard to their tendencies toward self-induced power oscillations. Data are presented on the following characteristics of the oscillations: power, pressure, temperature, reactivity amplitudes, and their rate of change; thresholds, and harmonic content. Results from three techniques of measuring the reactor transfer function are presented: the rod oscillation, the reactivity step, and the autocorrelation methods. Quantitative definitions of instability are introduced. Theoretical analysis of these reactors' kinetic behavior, based on a simple model where steam void feedbacks dominate, shows an adequate understanding of many of the phenomena, some even quantitatively. It is concluded that it is possible within the framework of existing experimental and theoretical boiling reactor dynamic technology, to design these reactors with reduced instability limitations on the power, and obtain power densities in excess of the current 50 kilowatts/liter of core. (auth)

16621 BNL-4261
Brookhaven National Lab., Upton, N. Y.
NUCLEAR ENGINEERING DEPARTMENT LMFR BIMONTHLY PROGRESS REPORT FOR JANUARY–FEBRUARY 1959. Apr. 20, 1959. 96p. $15.30(ph), $5.40(mf) OTS.

A detailed study of the breeding potential of U^{233} systems as a function of neutron spectrum was initiated. Analytical calculations of neutron capture in Bi resonances were completed. Final values of the buckling of the "19" stack are $6.24 \pm 0.31 \times 10^{-4}$ cm^{-2} (measured) and 6.36×10^{-4} cm^{-2} (calculated). Pulsed neutron measurements on GBF graphite gave results for the absorption cross section, transport mean free path, diffusion coefficient, and diffusion length. Ten materials were screened for corrosion resistance to a salt mixture consisting of 5% $BiCl_3$ in a ternary eutectic NaCl–KCl–$MgCl_2$. The behavior of different graphites toward Xe produced by irradiating U–Bi fuel was investigated. A ThO_2–Bi slurry containing 0.5 wt. % Mg was irradiated at 500°C for 5 months. The activity coefficient of Th in Bi was found to be 10^{-9} at 500°C, at infinite dilution. Further information was obtained about the electrochemistry of U^{3+} in fused salts. A large number of ThO_2 powders was prepared by aqueous methods. The stability of ThC_2–Bi was tested by contacting a 7.3 wt. % mixture at 600°C. ThO_2–Bi slurries were produced on both gram and kilogram scales. The minimum additive requirements for dispersing 10 wt. % of both Norton 900F ThO_2 and Norton 60F ThO_2 in liquid Bi at 600°C are 0.000029 to 0.000037 g atoms Mg per g ThO_2 or 0.000012 to 0.000015 g atoms Zr per g ThO_2. The addition of 1 wt. % Mg to U–Zr–Bi alloys partially eliminates the reduction of U solubility in Bi containing Zr. The solubility of U in Bi is increased by Cs additions up to 1.5 wt. % Cs. The addition of Na to U–Bi alloys caused the U solubility to increase to maximum at 2 wt. % Na and then to decrease as the Na content was increased to 8 wt. % Na. A slurry of $ThBi_2$ in Bi containing 3.34 wt.% Th, 0.41 wt.% Te, and 317 ppm Zr was circulated in a $2\frac{1}{4}$ Cr-1 Mo steel loop at 1.5 ft/sec through a bulk temperature differential of 21°C (444-465°C) for 1500 hr. Six new thermal convection loops were started to test the corrosion resistance of carbon steels and the effects of high maximum temperature and high temperature differential on corrosion of steels by inhibited Bi melts. Welding problems are discussed. Thermal conductivity measurements on irradiated graphites were made. Loop construction progress is summarized. (See also BNL-4097.) (W.D.M.)

16622 CENP-U-9
Combustion Engineering, Inc., New York.
PWR BOLTED CLOSURE MODEL VESSEL. Final Test Report. July 1956. 27p. CE Contract 7954. $4.80 (ph), $2.70 (mf) OTS.

Static pressure, external pipe loading, and pressure cycling tests were performed on the PWR Conical Segment Model Vessel. The test results verify the integrity of the PWR Vessel design for the anticipated mechanical loads. The maximum stress occurred at the intersection of the inlet nozzle and the inner wall of the lower head. The stress of 22,300 psi was induced by a stress concentration factor of 2.07. The average stress concentration was 1.86 for the inlet nozzle and the stress concentration for the outlet nozzle was 1.7. The maximum stress due to external loadings was 9,000 psi. This occurred in the region of the outlet nozzle. No damage to the vessel was observed after 94,000 cycles of alternating pressure between 1,000 psi and 2500 psi. (auth)

16623 CENP-U-10
Combustion Engineering, Inc., New York.
PWR CONICAL SEGMENT MODEL VESSEL. Final Test Report. July 1956. 40p. CE Contract 7954. $7.80 (ph), $3.30 (mf) OTS.

Static pressure, external pipe loading, and pressure cycling tests were performed on the PWR Bolted Closure Model Vessel. The tests verify the integrity of the bolted closure design. The maximum stress observed in the test was 34,000 psi for an internal pressure of 2500 psi. This stress occurred at the intersection of the outlet nozzle and the inner wall of the shell. The external pipe reaction loads, simulating those expected on the PWR vessel, induced a maximum stress of 2300 psi in the shell. Additional pipe reaction tests were performed to determine the response of the shell to circumferential and longitudinal moments. No visual damage to the vessel was observed after the model experienced 100,000 cycles of alternating pressure between 1,000 psi and 2500 psi. (auth)

16624 CF-58-5-83
Oak Ridge National Lab., Tenn.
COOLING WATER AND DEMINERALIZER ACTIVITIES IN NMSR. H. N. Culver. May 14, 1958. 49p. Contract [W-7405-eng-26]. $7.80 (ph), $3.30 (mf) OTS.

The activity in the cooling water and in the demineralizer is examined for activities resulting from water impurities, corrosion products, fission products and recoil atoms. The specific activity in the coolant resulting from these mechanisms is compared to the intrinsic activity in the coolant for two purification rates. The relative importance of corrosion and recoil activity is compared for reactor systems in general and specifically for the NMSR. The shielding requirements at the demineralizer are examined for an assumed rate of fuel element rupture and for demineralizer operation of 50 and 100 days. (auth)

16625 CF-58-7-61
Oak Ridge National Lab., Tenn.
CORE SOLUTION SYSTEM, RUN 22. P. H. Harley. July 21, 1958. 12p. Contract [W-7405-eng-26]. $3.30 (ph), $2.40 (mf) OTS.

The system was operated for 2623 hours at 1400 psi and 280°C. The fuel was 0.042 $\underline{m}$ UO_2SO_4 solution containing 0.025 $\underline{m}$ H_2SO_4 and 0.025 $\underline{m}$ $CuSO_4$. The generalized corrosion rate with a titanium letdown heat exchanger in the system was 0.80 mpy as compared to runs with a 347 SS heat exchanger in which the corrosion rate was 1.5 mpy. This corresponds to a 2.9 mpy generalized corrosion rate for the stainless steel heat exchanger. A preliminary solution inventory study was made which showed that the variance in the dump tank inventory was 180 times as large as in any other part of the system. A more accurate method to measure the contents of the dump tank will be required for a good system inventory. Precipitation of uranium between the pressurizer and the main loop was shown to depend upon the pressurizer purge rate and excess acid concentration. At 60% excess acid uranium would precipitate with the purge flow above 3 gph and at 55% excess acid uranium would precipitate above 2 gph purge flow. The fuel mixing rate into the motor end of the circulating pump was 2.7 to 3 liters per hour for 2200 hours of the run and then dropped steadily to 0.04 liters per hour during the last 400 hours. No explanation has been found for this change. (auth)

16626 CF-58-10-44
Oak Ridge National Lab., Tenn.
TRANSFER OF INITIAL FUEL FROM THE HRT AND RECOVERY OF THE ASSOCIATED HEAVY WATER. R. H. Winget. Oct. 3, 1958. 6p. Contract [W-7405-eng-26]. $1.80 (ph), $1.80 (mf) OTS.

The initial HRT fuel charge, contaminated with over 500 g corrosion product nickel, was processed to recover the D_2O and was transferred to Bldg. 3503 on September 26, 1958, for uranium decontamination. A total of 379 lb of D_2O was recovered from an estimated inventory of 410 lb. A total of 5.92 kg of uranium was transferred compared to a book inventory of 6.32 kg. The difference is thought to be that held up in the reactor or transfer piping since no known losses occurred in the transfer operations. (auth)

16627 CF-59-1-143
Oak Ridge National Lab., Tenn.
DETERMINATION OF MAXIMUM PERMISSIBLE LEAKAGE FROM THE HRT PROCESS STEAM SYSTEM. E. H. Gift. Jan. 30, 1959. 32p. Contract [W-7405-eng-26]. $6.30 (ph), $3.00 (mf) OTS.

Calculations were made to determine the radiation hazard to HRT personnel as a result of leakage to the atmosphere from the process steam system in the event of a heat exchanger tube rupture. These calculations show that with the present four-minute delay before dumping approximately 1020 lb of fuel solution may be transferred to the steam system. The radiation hazard from fission products in the atmosphere will be negligible if the steam killer blower is operating. If this blower is not operating, a natural convection loop will be set up in the steam killer which will have a condensing capacity of 4 lb/min of steam at atmospheric pressure. In this latter case, the inhalation hazard will be negligible when the leak rate through the steam stop valves is less than 4 lb/min. (auth)

16628 CF-59-6-8
Oak Ridge National Lab., Tenn.
A METHOD FOR DETERMINING THE OPTIMUM DIMENSIONAL PARAMETERS OF A SCALLOPED CHANNEL SO AS TO MINIMIZE FUEL-ELEMENT BOWING IN A SEPTAFOIL ARRANGEMENT. J. L. Wantland and G. J. Kidd, Jr. June 12, 1959. 22p. $4.80(ph), $2.70(mf) OTS.

The use of a scalloped cross-sectional coolant channel has been suggested as a possible solution of the fuel-element bowing problem inherent in the septafoil type of geometry. Using simplified assumptions, a method has been developed for calculating the rod spacing and scallop size necessary to produce equal average fuel-element surface temperatures in the central and peripheral regions of the coolant flow channel at the mid-section of each fuel-rod cluster under a given set of reactor flow conditions. Since the extent of rod-bowing is related to the surface temperature distribution, this requirement should minimize fuel-element deflection. (auth)

16629 CRCE-820
Atomic Energy of Canada Ltd., Chalk River, Ont.
THE INTERNAL INSULATION OF REACTOR PRESSURE TUBES. 4. ECONOMIC ASSESSMENT FOR A LARGE HEAVY-WATER-MODERATED POWER REACTOR. H. K. Rae. Apr. 1959. 48p. (AECL-827). $1.50(AECL).

In heavy-water-cooled and -moderated power reactors such as NPD-2 and CANDU the coolant will be insulated from the moderator by a gas layer external to the pressure tubes. Therefore, these tubes must be designed to operate at the maximum coolant temperature. However, by placing the insulation inside the pressure tubes they can be kept cold; a thinner wall or a higher reactor operating temperature can be used, and a wider range of pressure tube materials may be considered. Two kinds of internal insulation are considered: the cooled pressure tube in which stagnant heavy water is the insulation, and the cooled stress tube in which magnesium oxide is the insulation. Both are compared with externally insulated pressure tubes by calculating the cost of power for a series of reactors in which only the arrangement of the pressure tube and insulation is varied. For Zircaloy pressure tubes the use of internal insulation is estimated to reduce the cost of power by about 0.2 mill per kwh from that obtained with external insulation. This is a sufficiently attractive potential saving to warrant further development work on the cooled-Zircaloy-tube concept. Neither aluminum nor magnesium are attractive materials for cooled pressure tubes. The two types of internal insulation result in the same cost of power and they will have to be compared on the basis of their technical performance. Studies of the cooled stress tube are not as yet sufficiently advanced for this to be done. (auth)

16630 DANATOM-05-59
Danish Assn. for Industrial Development of Atomic Energy, Hellerup.
BEREGNING AF VARMEVEKSLERE FOR PWR. (Calculation of Heat Variations for PWR.) P. Scheel Larsen. [Feb. 1959.] 16p.

A preliminary study of the heat variations in a pressurized water reactor is made with emphasis on the ALPHA ship reactor project. On the basis of a literature search and heat calculations for the Savannah and Shippingport reactors, the boiling heat transfer was calculated without consideration of correction factors. (J.S.R.)

16631 DANATOM-06-59
Danish Assn. for Industrial Development of Atomic Energy, Hellerup.
CONTAMINATION OF THE PRIMARY LOOP IN A WATER COOLED REACTOR. May 1959. 47p.

A literature study was conducted to find the most suitable methods and reliable results of nuclear experiments applicable to the Danatom ship reactor Alpha. The recommended specifications for the primary water are nearly identical with those for the Shippingport Power Station. If the shielding is dimensioned on the Shippingport assumption that 1% of the fuel elements may be defective, it must be designed for a coolant activity of 1.2 × 10^5 disintegrations/sec/cm^3. Corrosion rates are also discussed as well as estimates of activity as a result of a single fuel element destruction and activity due to one damaged element. Activity of corrosion products is also considered, and it is concluded that after 5 years of operation the activity deposited on the surface of the primary system will be about 2 × 10^5 disintegrations/sec/cm^3. (J.R.D.)

16632 GA-570
General Atomic Div., General Dynamics Corp., San Diego, Calif. and General Dynamics Corp. Electric Boat Div., Groton, Conn.
EVALUATION OF COOLANTS AND MODERATORS FOR THE MARITIME GAS-COOLED REACTOR. Dec. 10, 1958. 473p. $6.00(OTS).

The power plants investigated for the Maritime Gas-Cooled Reactor were: carbon dioxide cooled light water moderated, carbon dioxide cooled zirconium hydride moderated, and carbon dioxide or helium cooled graphite moderated. A thermodynamic and heat-transfer comparison was made of helium and carbon dioxide. Studies were made of the material problems concerning choice of moderator and coolant. The effect of coolant composition and pressure on rotating machinery and related equipment was studied. A steam-cycle power plant with helium-cooled, graphite-moderated reactor was studied. (W.L.H.)

16633 IDO-28541
Aerojet-General Nucleonics, San Ramon, Calif.
ARMY GAS-COOLED REACTOR SYSTEMS PROGRAM. Monthly Progress Report [for] May 1959. June 29, 1959. 41p. Contract AT(10-1)-880. $7.80(ph), $3.30 (mf) OTS.

The activities of the Army Gas-Cooled Reactor Systems Program for May 1959 are presented. The program includes a water-moderated heterogeneous reactor (Gas-Cooled Reactor Experiment I), a graphite-moderated homogeneous reactor (Gas-Cooled Reactor Experiment II), a mobile, gas-cooled reactor (ML-I), and the Gas Turbine Test Facility. The progress of each project, its associated tests and data evaluation, the applicable design criteria, and the fabrication of reactor components are reported. (For preceding period see IDO-28540.) (auth)

16634 NAA-SR-2399
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
ORGANIC MODERATED REACTOR EXPERIMENT QUARTERLY PROGRESS REPORT FOR APRIL—JUNE

1957. C. A. Trilling, ed. Dec. 31, 1958. 48p. Contract AT-11-1-GEN-8. $1.25(OTS).

An investigation was conducted to determine the magnitude of error in surface temperature measurements of the OMRE fuel plate, using a chromel-alumel thermocouple assembly. Apparatus for the purpose of this calibration was fabricated and tested. Performance tests on control rods are described. Three tests on the time interval between scram signal and downward movement of the poison elements were run. Shielding studies on the fuel handling coffin were performed. Experimental forced convection heat transfer and fouling runs with unirradiated Santowax O-M (2 parts ortho-, 1 part meta-terphenyl) were completed. The carbon and hydrogen content of irradiated coolants was determined in order to measure the effect of coolant decomposition on moderating ability. The effects of radiation on the density of ortho-, meta-terphenyl and Santowax R were determined over the temperature range 300 to 850°F, while the density of irradiated diphenyl was determined from 300°F to its normal boiling point. The viscosity of irradiated ortho-, meta-terphenyl was determined over the temperature range 300 to 850°. The melting point of irradiated diphenyl was determined. Distillation curves for the irradiated coolants are given. Results from acceptance tests on ortho-, meta-terphenyl are presented. (For preceding period see NAA-SR-2150.) (W.D.M.)

16635 NAA-SR-3300
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
PRELIMINARY DESIGN DESCRIPTION FOR THE PIQUA ORGANIC MODERATED REACTOR PLANT, PIQUA, OHIO. [1959?]. 55p. Contract AT-11-1-GEN-8. $9.30(ph), $3.60(mf) OTS.

The Piqua OMR has a rating of 45.5 Mwt and in conjunction with steam generating equipment produces 150,000 lb/hr of steam for use in existing turbine generators. Approximately 11.4 Mw of electricity will be generated when the reactor is operating at full power. The reactor uses slightly-enriched, metallic uranium alloy as a fuel and is cooled and moderated by an organic hydrocarbon, Santowax R, a commercially available mixture of terphenyls. (A.C.)

16636 NAA-SR-3467
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
FIRST SODIUM REACTOR EXPERIMENT (SRE) TEST OF HALLAM NUCLEAR POWER FACILITY (HNPF) CONTROL MATERIALS. S. O. Arneson. June 1, 1959. 31p. Contract AT-11-1-GEN-8. $1.00(OTS).

An experiment was conducted in the SRE to measure temperatures and neutron flux levels in and near a boron-containing simulated control rod. The data are being used to check analytical methods developed for prediction of control rod heat generation rates and maximum temperatures in this type of control rod in the Hallam Nuclear Power Facility. The maximum observed temperatures with a reactor power level of 20 Mw were 1363°F for a boron-nickel alloy ring having a 0.105-in. radial clearance with the thimble and 1100°F for a boron-nickel alloy ring having a 0.020-in. radial clearance. The maximum temperature difference between the coolant and the control rod was 473°F. It is concluded that the expected greater heat generation rates in the Hallam reactor would prohibit the use of boron-containing absorber materials in a combined shim-safety rod. (auth)

16637 NAA-SR-Memo-1750
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
OMRE PROCESS INSTRUMENTATION. R. P. Varnes. [nd]. 29p. $4.80(ph), $2.70(mf) OTS.

A detailed description is given of the instrumentation involved in the heat transfer system, the purification system, the nitrogen supply system, the water cooling system, and the make-up system. Most of the information presented is in tabular form. An attempt is made to justify the existence of the described instruments. (W.D.M.)

16638 NAA-SR-Memo-1772
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
OMRE PRE-OPERATION TESTING PROGRAM SUMMARY. E. B. Ash, K. H. Campbell, and B. L. Moskowitz. Oct. 1956. 30p. $6.30(ph), $3.00(mf) OTS.

The pre-operational testing program is described which is to be conducted on the reactor components, cooling circuits, organic purification system, service systems, and control and process instrumentation to verify adequate operability and establish operational parameters. Some of the tests to be conducted include low power operation of the reactor and full power operation of the cooling systems. The tests are grouped according to construction phase, checkout phase, critical experiment, or low power operation. (W.D.M.)

16639 NAA-SR-Memo-1779
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
OMRE OPERABILITY TEST PROCEDURES PRE-OPERATIONAL TESTING PROCESS EQUIPMENT. N. J. Swanson. Oct. 1956. 121p. $19.80(ph), $6.30 (mf) OTS.

The OMRE operability test procedures will aid in determining whether the process equipment as installed will satisfactorily perform as required by design specifications. It is absolutely essential that any serious limitations to the design requirements resulting from defective equipment, improper installation, faulty design, or other reasons be discovered before the equipment becomes radioactive from the reactor operation. Test procedures are given on flow capacity, heating rates, instrument functionability, leakage rates, controllability and sensitivity, operation time cycles, and simple calibrations. (W.D.M.)

16640 ORNL-2723
Oak Ridge National Lab., Tenn.
MOLTEN-SALT REACTOR PROJECT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING APRIL 30, 1959. June 26, 1959. 106p. Contract W-7405-eng-26. $2.50(OTS).

The effects of fuel processing by the ion-exchange method at a rate of once per year and at a rate of 12 times per year were compared for the Interim Design Reactor fueled with U^{233}. The nuclear performance of a one-region, graphite-moderated, unreflected, thorium-conversion molten-salt-fueled reactor was studied to evaluate the effects of processing the fuel at the rate of once per year and 12 times per year, the effects of decreasing the thickness of the core vessel and adding a blanket, and the effects of using a graphite core vessel and blanket. The initial nuclear characteristics of a one-region, heterogeneous, graphite-moderated and -reflected, thorium-conversion, molten-salt-fueled reactor were studied. It was found, that with 13 and 7 mole % ThF_4 in the fuel, maximum regeneration ratios of 0.846 and 0.798 at inventories of 1150 and 900 kg of U^{235} were obtained. Calculations were also made of the performance of two-region, graphite-moderated, molten-salt-fueled, breeder reactors. The effects of fast-neutron reactions in Be^9 on the reactivity of molten-salt-fueled reactors were studied. Component development and testing including journal bearings, seals, corrosion-testing loops, and MTR in-pile loops are described. The enthalpy, heat capacity, viscosity, and surface tension were experimentally determined for several additional fluoride salt mixtures containing BeF_2 with varying amounts of UF_4 and/or ThF_4. Corrosion studies were completed on four INOR-8 and four Inconel thermal-convection loops. The effects of penetration of graphite by molten-fluoride-salt fuels are being investigated in order to evaluate the problems associated with the use of unclad graphite as a moderator. A series of tests were run to investigate the precipitation of U from fuel 130 ($LiF-BeF_2-UF_4$) held in a graphite crucible at 1300°F. Several brazing alloys were tested for compatibility with fuel 130. A specimen of INOR-8 was examined for evidence of carburization that had been exposed to fuel 130 for 4000 hr in a thermal-convection loop hot leg at 1300°F. The critical results obtained from rotating-beam fatigue tests at 1500°F indicate that INOR-8 has significantly better fatigue resistance than Inconel. Based on the results of tensile tests conducted on specimens of INOR-8 aged for 10,000 hr at 1000 to 1400°F, it was concluded that INOR-8 does not exhibit embrittling tendencies that can be attributed to high-temperature instability. Procedures are being developed for fabricating INOR-8 material ranging in size from thin-walled tubing to heavy plate. A method was developed for brazing graphite to Inconel. Phase diagrams for the systems $LiF-BeF_2-ThF_4$ and $NaF-BeF_2-ThF_4$ were prepared, and the identity and approximate locations of primary phases in the system $NaF-ThF_4-UF_4$ were determined. The $SnF_2-NH_4HF_2$ system was investigated because of its potentialities as a strongly oxidizing, low-melting solvent for reprocessing fuels. Measurements were made of the solubility of PuF_3 in $LiF-BeF_2-UF_4$ (70-10-20 mole %). The possibility of separating LiF from the mixture $LiF-BeF_2$ (63-37 mole %) by adding NaF and decreasing the temperature was investigated. Tests were initiated for determining the rate of exchange in a proposed method for decreasing the total rare earth content of molten fluoride salts. Two methods for separating U from fission products are being studied. Measurements were made of the solubility of neon in $LiF-BeF_2$ and CO_2 in $NaF-BeF_2$. Melts from operating INOR-8 and Inconel forced-circulation loops were analyzed for chromium. Test of the permeability of graphite by molten fluoride salts were continued. A device for testing a proposed fuel sampling and enriching mechanism was constructed and tested. The use of molten ammonium bifluoride as a reactant for preparing both simple and complex fluorides and the preparation of pure chromous fluoride by the reaction of Cr metal with molten stannous fluoride were studied. Studies of the processing of molten fluoride salt fuels by the fluoride-volatility process were continued. (For preceding period see ORNL-2684.) (W.D.M.)

16641 PRDC-TR-20
Power Reactor Development Co., Detroit.
MONTHLY TECHNICAL REPORT [FOR] FEBRUARY 1959. 11p. Contract AT(11-1)-476. \$3.30(ph), \$2.40(mf) OTS.

The status of the design and fabrication of the major components being procured by APDA for the Reactor Components Test is shown. Work is summarized on various projects including the CP-5 Irradiation Program, fuel irradiations, metallographic examination, corrosion studies, oscillator and control rods, instrumentation, and test operations. (For preceding period see PRDC-TR-19.) (W.D.M.)

16642 WAPD-PWR-PC-1721
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
REACTOR PROTECTION AND CORE MONITORING AFTER 3500 EFPH—PWR PROJECT. J. R. LaPointe. Feb. 20, 1959. 5p. Contract AT-11-1-GEN-14. \$1.80(ph), \$1.80(mf) OTS.

Reactor protection and core monitoring recommendations for PWR Core 1 Seed 1 up to 6000 EFPH are presented. A curve of the maximum allowable protection setting as a function of core life is determined. To provide rod withdrawal accident protection to 6000 EFPH, the nuclear level overshoot during the worst case transient is determined. Assuming a temperature coefficient of reactivity of -1.0×10^{-4} $\delta k/°F$, the rate of power level rise in the range 125 to 150% full power is 38%/sec. (W.D.M.)

16643 WAPD-PWR-PMF-114
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
PWR CONTROL AIR SYSTEM (REACTOR PLANT PORTION); SYSTEM DESIGN DESCRIPTION. D. J. McDonald. Jan. 11, 1956. 10p. Contract AT-11-1-GEN-14. \$1.80(ph), \$1.80(mf) OTS.

A design description of that portion of the control air system within the PWR reactor plant container concrete enclosure, the air treatment room, auxiliary equipment room, and the boiler access tunnels is described. The essential design features of the equipment are included. (A.C.)

16644 WAPD-PWR-PMF-115
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
PWR STATION SERVICE AIR SYSTEM (REACTOR PLANT PORTION); SYSTEM DESIGN DESCRIPTION. D. J. McDonald. Jan. 14, 1956. 11p. Contract AT-11-1-GEN-14. \$3.30(ph), \$2.40(mf) OTS.

A design description is presented of the station service air system within the PWR reactor plant container concrete enclosure and auxiliary equipment room No. 1. The essential design features of the equipment are included. (A.C.)

16645 WAPD-PWR-PMF-364
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
REGENERATION OF THE PWR CANAL WATER DEMINERALIZER RESIN. A. P. Zechella. 10p. PWR Project. Includes Appendices I, II, III, and PFS-Sketch No. 21. Contract AT-11-1-GEN-14. \$1.80(ph), \$1.80 (mf) OTS.

The regeneration of PWR canal water system demineralizer resin was investigated. The normal mode of handling spent demineralizer resin is underground storage. An operational procedure for the regeneration process is given which will allow reuse of the demineralizer and a saving of about \$47,000 with a six month regeneration cycle. (J.R.D.)

16646 WAPD-TM-190
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
STOCHASTIC FLUCTUATIONS IN A POWER REACTOR.
D. R. Harris. Nov. 1958. 40p. Contract AT-11-1-GEN-14. $1.25(OTS).

The neutron and delayed neutron precursor contents and the temperature of a reactor are treated as random variables participating in a multiplicative stochastic process. It is shown that stationary fluctuations in these variables are moderated by the presence of delayed neutrons, a large neutron source, and a large negative temperature coefficient. Reactor instability with a positive temperature coefficient is discussed in terms of the non-existence of a stationary process. (auth)

16647
THE 10 MW HIGH-TEMPERATURE REACTOR "DRAGON." H. W. Schmidt (Arbeitsgemeinschaft BBC/Krupp, Mannheim, Ger.). Atomwirtschaft 4, 211-16(1959) May. (In German)

The 10 Mw reactor "Dragon" is being developed in Great Britain in coöperation with eleven other countries. Its characteristics include high burnup and conversion factor, high power density, and high coolant temperature. Problems being investigated include the extreme requirements on chemical purity of coolant gas, susceptibility to disturbance through faulty operation or failure of safety arrangements, and radioactive contamination of the cooling circuit. (auth)

16648
THE USE OF NUCLEAR ENERGY IN THE TRANSPORTATION FIELD. Basilio Focaccia. Ing. nucleare No. 1, 5p.(1959). (In Italian)

The problem of the application of nuclear energy to the transportation field is examined. The positive and negative aspects of this problem are discussed, with the Nautilus as an example, The realizations in this area and the research being done in various countries are reviewed. (J.S.R.)

16649
PRINCIPAL ECONOMICAL QUESTIONS CONCERNING THE PROCESSING OF IRRADIATED FUELS. Jiří Beránek (Chemical Project, Prague). Jaderná energie 5, 117-23(1959). (In Czech.)

The influence of the principal factors on the economic efficiency of the processing of irradiated fuels was evaluated. The influence of burnout is discussed, and the necessary conditions for economical reprocessing are set. For a given system of reactors the costs of different fuel cycles are analyzed. The minimum economical capacity of a processing plant is set out, and the influence of the transport distance from the power stations to the plant is determined. (auth)

16650
STEAM COOLING. THE VICKERS NUCLEAR ENGINEERING SHIP PROPULSION PROPOSAL. Nuclear Eng. 4, 246-9(1959) June.

A modified land-based steam-cooled heavy-water-moderated reactor is described. The reactor was originally conceived as a marine reactor. The large negative temperature coefficient at all power levels should permit the introduction of plutonium once metallurgical conditions have been satisfied. The fuel is uranium dioxide enriched to 1.7% and canned in stainless steel. The coolant enters the top of the reactor at a temperature of 260°C and is heated to 520°C. The mean steam pressure is 600 psia. In the prototype model it is proposed that the primary circuit contain a secondary heat exchanger in which steam is raised to drive the turbine. (A.C.)

16651
CHAPELCROSS. Nuclear Eng. 4, 250-2(1959) June.

Chapelcross is similar but not a copy of Calder Hall. The station is intended primarily for plutonium production, simultaneously providing 140 Mw of electrical energy. The first reactor went on load February 25, 1959. (A.C.)

16652
FUEL ELEMENTS FOR DRESDEN. C. N. Spalaris (General Electric Co., San Jose, Calif.). Nuclear Eng. 4, 253-8(1959) June.

The 180-Mw Dresden station will have a reactor of the uranium dioxide, boiling-water type. Each fuel rod is about 10 ft long, assembled from 27-in. segments. The latter consist of Zircaloy-2 tubing filled with sintered pellets and closed by plugs welded to the ends. Probable future trends regarding fabrication cost of these elements are discussed. (A.C.)

16653
TEMPERATURE AND REACTIVITY. J. J. Syrett (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Power 4, No. 37, 95-7(1959) May.

The sensitivity of power reactors to temperature changes is discussed. A summary of the main temperature changes is given with special emphasis on gas-cooled reactors. (A.C.)

16654
A BWR FOR MERCHANT SHIP PROPULSION. R. L. Schmidt and L. F. Ridrych (General Electric Co., [San Jose, Calif.]). Nuclear Power 4, No. 37, 106-8 (1959) May.

A design study has been completed for converting a tanker to nuclear propulsion. The direct cycle boiling water reactor system is basically the same as reactor designs developed for small generating stations. Mechanical design features are incorporated which are necessitated by marine service requirements. The plant is designed to furnish 22,000 shp and steam for operation of all power plant and ship auxiliaries. The fuel is slightly enriched uranium dioxide, fabricated as sintered solid cylindrical pellets and stacked in Zircaloy tubing. (A.C.)

16655
INTRODUCTION TO NUCLEAR POWER COSTS. NUCLEAR ENGINEERING MONOGRAPHS. Arnold Rochman. New York, Simmons-Boardman Publishing Corp., 1959. 55p.

The study analyzes some of the factors which make up the total cost of nuclear power and how variations in their value may affect the over-all cost structure. Fuel costs, plant and equipment costs, and costs of services are analyzed in detail. (A.C.)

16656

NAVAL REACTORS PHYSICS HANDBOOK. VOLUME III. THE PHYSICS OF INTERMEDIATE SPECTRUM REACTORS. J. R. Stehn, ed. Washington, D. C., U. S. Atomic Energy Commission. 523p. $3.00(GPO).

The accumulated physics experience of the Knolls Atomic Power Laboratory in its work on intermediate spectrum reactors is presented. The importance of the properties of critical assemblies and of the techniques for obtaining experimental information about such assemblies is considered. The use of both critical assemblies and reactor theory to make and test predictions on the manner in which the reactivity of an intermediate power reactor will vary during operation is detailed. Space and time distribution of reactor heat generation and nuclear effects of Be and Na in the core are considered. Transient or near-transient behavior of intermediate reactors is reviewed. (W.D.M.)

16657

NUCLEAR REACTOR PLANT. Stichting Reactor Centrum Nederland (Netherlands). British Patent 803,569. Nuclear Eng. 4, 284(1959) June.

It has been proposed to enclose a reactor and any other parts of the plant where leakage and scattering of radioactive materials could occur in a common shell strong enough to resist all pressures in the case of plant failure. This shell would have to be very large even for a small nuclear reactor; in one existing plant a spherical steel shell of a diameter of 65 m is employed. A simple solution of the problem would be the provision of a shell enclosing the reactor and associated apparatus, connected to an expansible gas-holder situated outside. Then, in the event of an undue rise of pressure the gas would flow to, and collect in, the gas-holder. The gas-holder should preferably be of the wet gasometer type in order to facilitate condensation of the gases and vapors. Costly liquid (heavy water) may thus be recovered from the condenser.

16658

VAPOUR GENERATORS. W. R. Wootton and Babcock and Wilcox, Ltd. British Patent 803,382. Nuclear Eng. 4, 284(1959) June.

Normally, the general layout of a nuclear power station employing a gas-cooled reactor as the primary heat source provides for the reactor proper to be housed in a building unit of its own and the vessels containing the heat exchangers to be situated externally, connected with the reactor shell by ducting for the circulation of the coolant. A saving in initial cost can be effected by placing the reactor, the circuit for the gaseous coolant, and the heat exchangers within a common pressure vessel. In one embodiment of the invention, the pressure vessel is cylindrical, positioned vertically and its bottom portion, which is of a large diameter, houses the reactor. This part of the pressure vessel is surrounded by a biological shield of concrete. In addition, the space within the upper portion of the pressure vessel is protected by an internal, horizontally placed, biological shield. The latter part of the pressure vessel projects beyond the outer biological shield and houses the heat exchangers. The coolant is circulated by means of built-in fans along a well defined path within the pressure vessel. The second embodiment represents an arrangement based on the same principles designed to suit a pressure vessel of spherical shape.

STABLE ISOTOPE SEPARATION

16659 A/CONF.15/P/180

ENRICHMENT OF DEUTERIUM BY DISTILLATION OF DISSOCIABLE COMPOUNDS. K. E. Holmberg (Atomenergi AB., Stockholm). 6p.

The physical properties of the compounds pyridine–hydrogen chloride, propylamine–hydrogen sulfide, methylethylamine–hydrogen sulfide, and corresponding compounds containing deuterium in exchangeable positions have been investigated. It is concluded that separation factors for H/D amounting to 1.06–1.11 may be obtained at the distillation of these compounds at atmospheric pressure. In some respects the new systems may be somewhat more favorable than water as media for enrichment of deuterium by distillation. (auth)

16660 AERE-Lib/Trans-799

THE ENRICHMENT OF HEAVY WATER BY HIGH-PRESSURE EXCHANGE BETWEEN HYDROGEN AND AN AQUEOUS CATALYST SUSPENSION. E. W. Becker, R. Hübener, and R. Kessler. Translated by S. Asher (U.K.A.E.A. Atomic Energy Research Establishment) from Chem. Ing. Tech. 30, 288-(1958). 26p.

Chemical exchange between hydrogen and water is especially suitable for the technical production of heavy water because of its relatively high isotope displacement and the favorable chemical properties of the reacting species. The economics of a procedure using this system depends largely on the properties of the catalyst required for the isotopic exchange. It is shown that the high-pressure exchange between hydrogen and an aqueous catalyst suspension in hot/cold columns has economic advantages over the hitherto accepted procedure for the enrichment of heavy water. (auth)

16661

A LABORATORY APPARATUS FOR DEUTERIUM ENRICHMENT BY THE RECTIFICATION OF LIQUID HYDROGEN. R. H. Weisser. Sulzer Tech. Rev. (Switz.) 40, No. 3, 71-4(1958).

A small column is described for the distillation of liquid H_2, and an account is given of tests carried out on the separation of H_2–HD mixtures. (auth)

16662

PROCESS FOR SEPARATING GASEOUS OR VAPOROUS SUBSTANCES, MORE ESPECIALLY ISOTOPES. Deutsche Gold-und Siber-Scheideanstalt vorm. Roessler (Germany). British Patent 803,689. Nuclear Eng. 4, 284(1959) June.

Reference is made to B.P. 794,834 which describes a process of separating gaseous or vaporous substances of different molecular weight and/or molecular diameter, in particular isotopes. The separating system consists of a nozzle and an apertured diaphragm which is placed in the path of the jet, formed by the mixture when passing through the nozzle, and dividing the jet into a core stream and a peripheral stream, the heavier and lighter components of the mixture thus being concentrated in the respective component streams. In order to obtain good quality separation, it is important to maintain a specific ratio of the pressure of the gas entering the nozzle to the pressure of the gas leaving the nozzle, this ratio varying from 100 : 1 to 1,000 : 1. In the previously described form of the process, suitably designed pumps were employed for maintaining these pressure ratios with delivery of the streams of vapor or gas. Where the method is employed in the form of a multistage process, a plurality of pumps with high capacities is required making the equipment expensive. In the present patent a revised version of the method is described, eliminating the use of pumps for this purpose. Instead, the transport of the gases and vapors through the separating system is effected by successive vaporization and condensation steps, resulting from periodical addition and withdrawal of heat. The process being carried out in the sub-atmospheric pressure range can also be used for subliming substances, e.g., for the concentration of uranium isotopes from uranium hexafluoride.

16663

ENRICHMENT OF WATER IN DEUTERIUM OXIDE. (to United Kingdom Atomic Energy Authority). British Patent 800,730. Platinum Metals Rev. 3, 33 (1959) Jan.

A method of enriching water in deuterium oxide consists in bringing together water and deuterium-containing hydrogen in the presence of Ru, Rh, Pd, Os, Ir, or Pt, as catalyst for the exchange reaction.

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